WIRE AND WIRE PRODUCTS

OCTOBER 1944

VAUGHN

Versatile

WIRE DRAWING EQUIPMENT

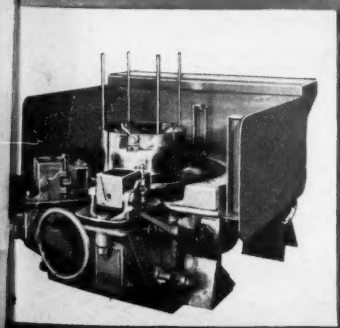
SPEEDS PRODUCTION WHEREVER MINUTES COUNT *NOW* . . . . . PROVIDES THAT BUILT-IN VERSATILITY THAT MAKES YOUR RECONVERSION *EASY* TOMORROW.

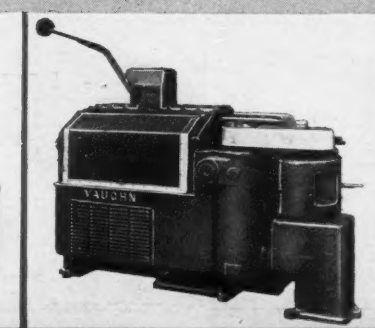
THE VAUGHN MACHINERY CO.

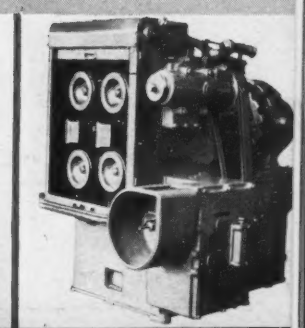
CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT

Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

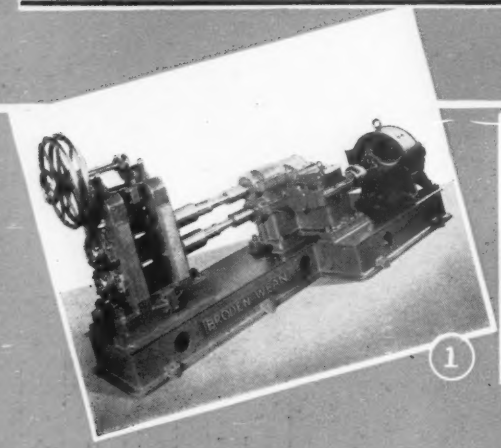






OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

WEAN-BRODEN



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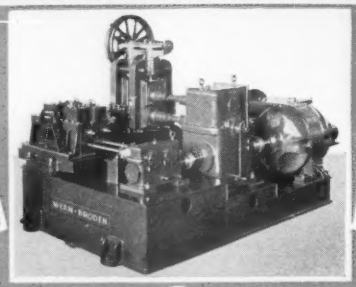

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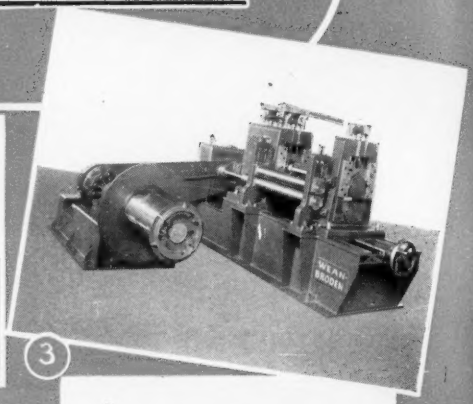

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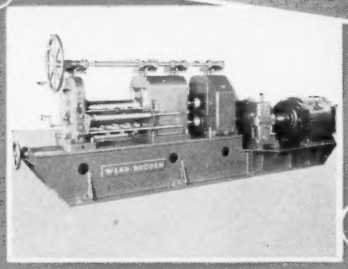


4

THE Wean Engineering Company, Inc., have long been recognized as Specialists in sheet, strip and tin mill equipment. . . . The Broden Construction Company specializes in the manufacture of narrow strip and wire mill equipment.

With the extended facilities of The Broden Construction Company as a subsidiary of The Wean Engineering Company, Inc., it is now possible to serve the steel industry more effectively.

1. Small Cold Rolling Strip Mill
2. Special Strip Cold Rolling Mill
3. Strip Reel and Slitting Unit
4. Heavy Duty Slitter
5. Special Alloy Single Draft Heavy Duty Vertical Wire Drawing Block for 5/8" Round Rod

COLD ROLLING MACHINERY

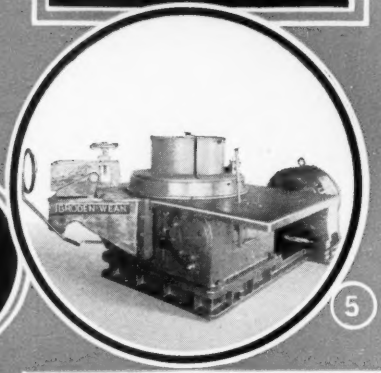
For 36" Wide Material and Narrower

Mills • Reels • Slitters • Levelers • Coilers • Edgers
Scale Breakers • Shears • Scrap Ballers
Continuous Pickling

WIRE MILL EQUIPMENT

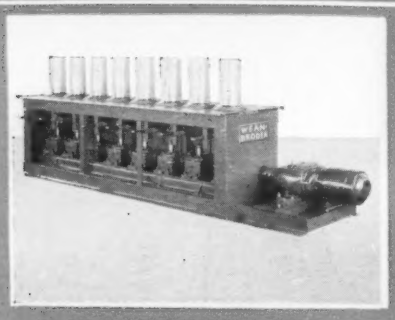
Wire Drawing Machines • Patenting • Galvanizing and Tinning Take-Up Frames • Wire Flattening • Spoolers
Nail Galvanizing and Blueing

HOLMQUIST BARBED WIRE *and* **WIRE FENCE MACHINERY**

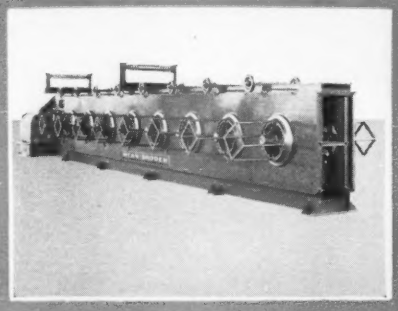


5

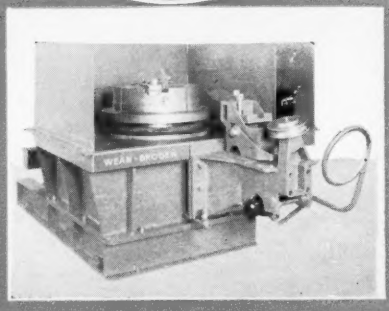
The BRODEN CONSTRUCTION Co., Inc., Cleveland, O.
A SUBSIDIARY COMPANY OF
The WEAN ENGINEERING Co., Inc., Warren, O.



FINE WIRE TINNING UNIT

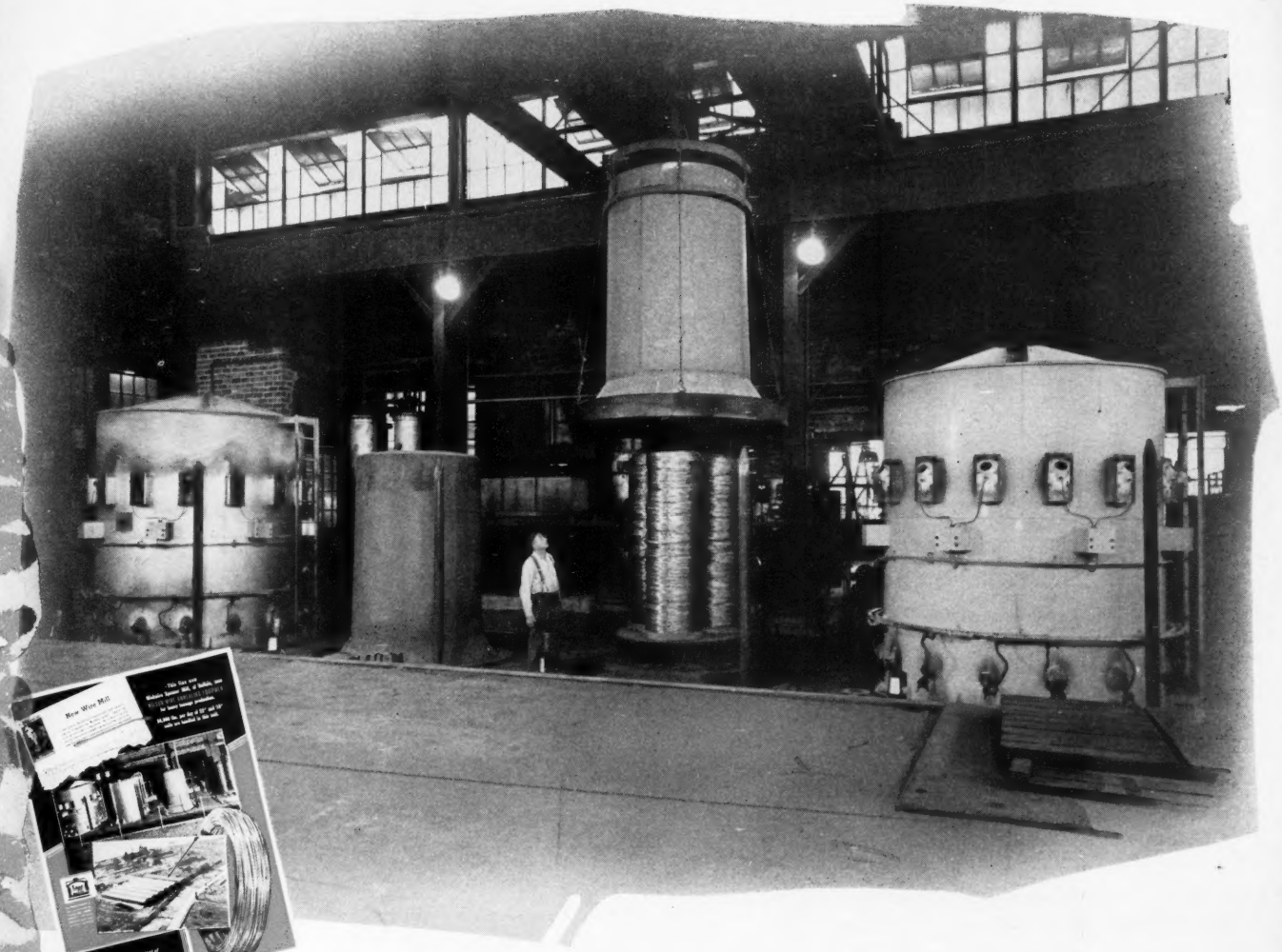


MULTIPLE WIRE TAKEUP FRAME



TWO DRAFT CONTINUOUS WIRE DRAWING MACHINE

WILSON WIRE ANNEALING FURNACES
for HEAVY TONNAGE PROCESS ANNEALING
of Low Carbon Steel Wire Coils



The first installation at Wickwire Spencer - 1940

This Wilson installation at Wickwire Spencer Company's Buffalo plant utilizes two 62″ x 84″ furnaces on four bases for heavy daily process annealing tonnages of 22″ and 16″ block coils. Larger base sizes with fan recirculation are available for larger and exceptionally heavy coils.

The Wilson Annealing Unit is covered by Patents Nos. 1,952,402, 2,068,477, 2,078,356, 2,081,612, 2,089,843 and other patents pending

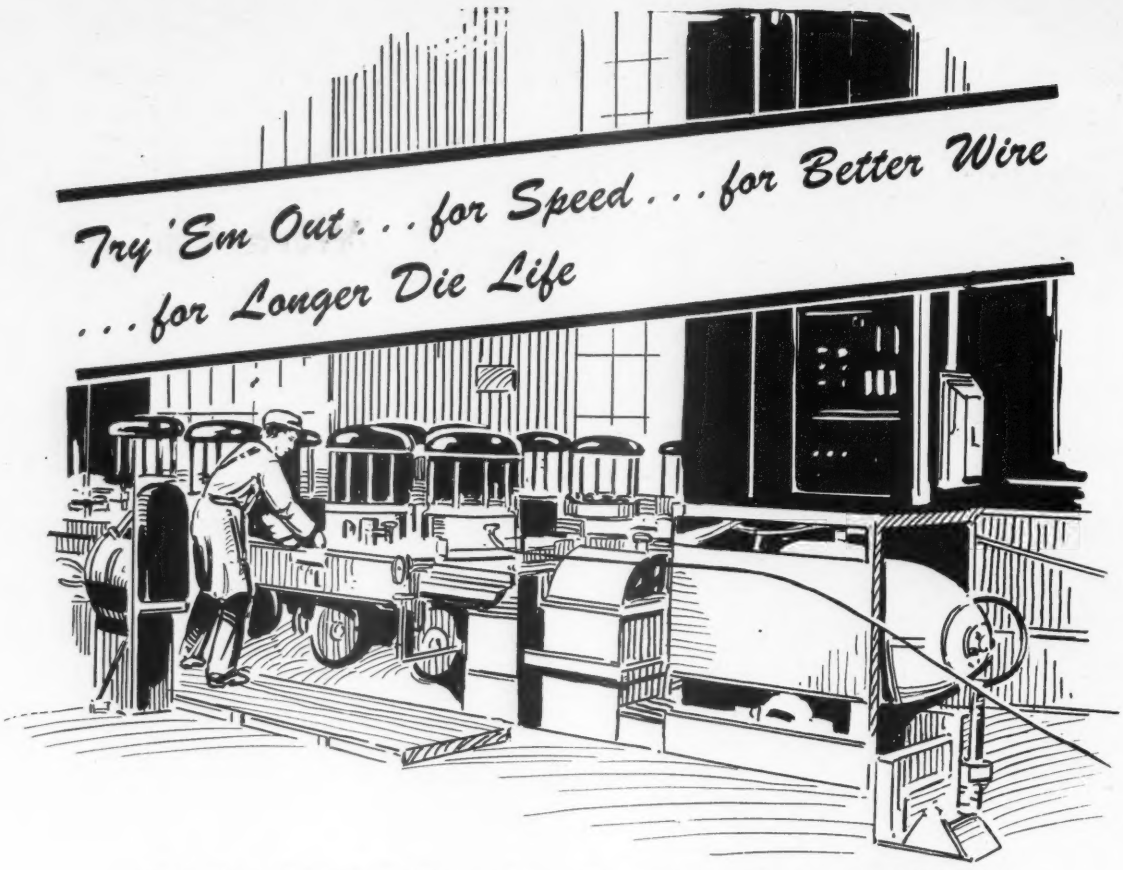
ENGINEERED AND CONSTRUCTED BY

Lee Wilson ENGINEERING Co., Inc.

20005 West Lake Road CLEVELAND, OHIO

Telephone ACademy 4670

INDUSTRIAL FURNACES ★ RADIANT TUBE HEATING ★ HEAT TREATING PROCESSES



"Tailor-Made" Drawing Compounds by MAGNUS

THE exacting demands of modern wire drawing for effective drawing compounds cannot be met by standardized lubricants. Not many months ago a speed of 500 feet per minute in multi-pass drawing of high carbon wire was excellent performance. But specially designed drawing compounds have boosted the rate so greatly that today speeds of as high as 1400 feet per minute are almost commonplace.

It is not possible to design a drawing compound in a laboratory which will completely meet special requirements. Long experience based on persistent research makes it possible to provide the major elements of a compound, but final refinements to meet production requirements must come from actual try-out on the wire itself.

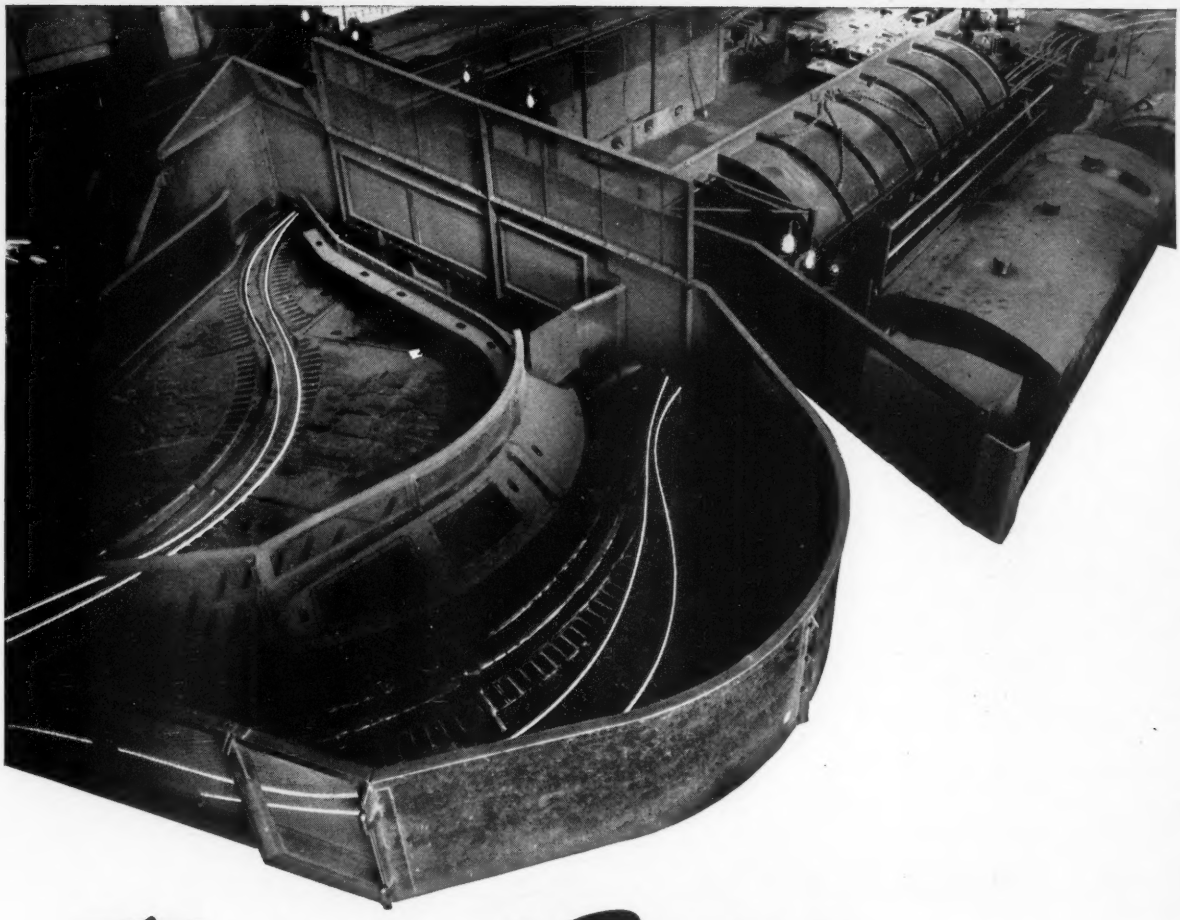
Magnus has always specialized in producing "tailor-made" drawing compounds to meet definite drawing problems and this process of trying out to provide the final refinements is a familiar one to us.

Have you any drawing operations where greater speed, better quality, longer die life or any other improvements are desirable? Let us work with you to design a special lubricant to reach those objectives.

Magnus

MAGNUS CHEMICAL COMPANY · 188 SOUTH AVENUE · GARWOOD, N. J.

WIRE DRAWING COMPOUNDS



Turning out RODS at 47 m.p.h.

"Here it comes . . . there it goes!" expresses the high speed at which rods are produced on Bethlehem's modern continuous rod mill. For on this mill, using the latest types of roll-stand equipment, No. 5 gauge .218-in. rod rushes from the finishing rolls at 4200 feet per minute—more than 47 miles per hour.

Modern automatic equipment makes possible the production of rods at this high rate of speed. Electric thermocouples assure uniform billet-heating temperatures. Special bearings cradle the rolls. S-curves are provided to absorb speed differentials. Individual motor drive provides close synchronization of roll-stands.

Bethlehem's modern continuous rod mill provides one example of this company's policy of bringing the latest improvements in facilities and processes to the service of its customers. As wire and as items made from wire, the products of Bethlehem rod mills are serving in hundreds of important applications on distant fighting fronts and in war-related uses here at home.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

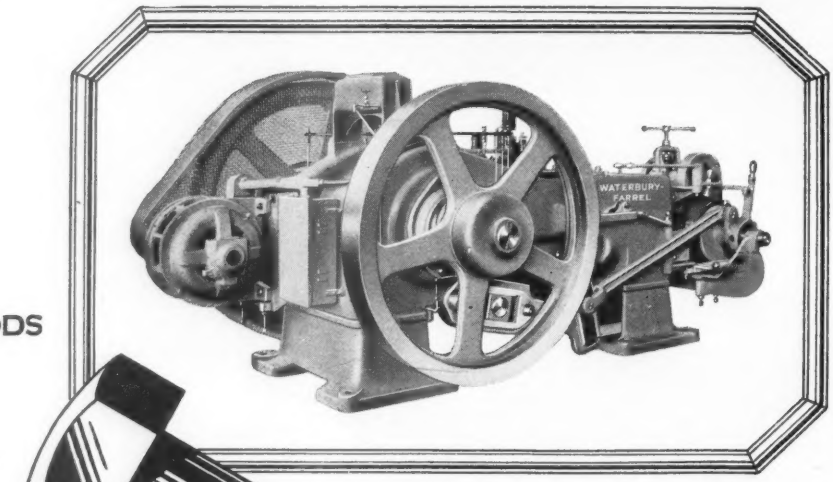
Bethlehem Steel Export Corporation
New York City

★ BETHLEHEM STEEL ★

BOLT AND NUT MACHINERY

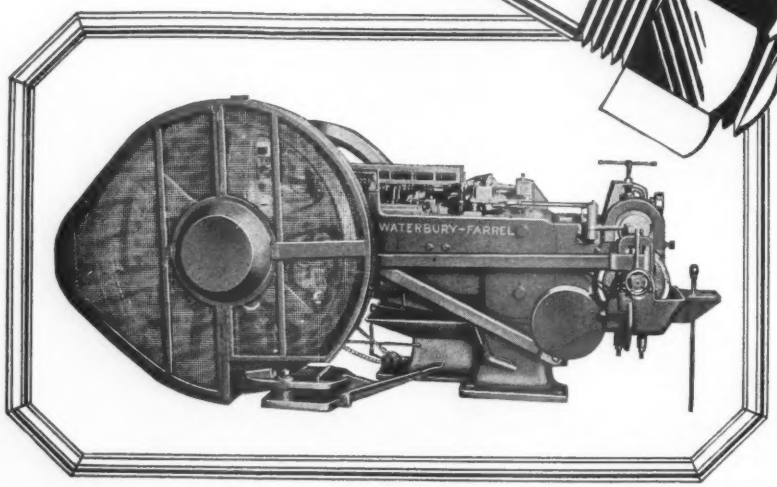
Cold Process Machinery for the Automatic Production of.....

BOLTS
SCREWS
NUTS
RIVETS
HEADED RODS
SPOKES
BALLS, ETC.



½-inch Open Die Double Stroke Crank Header with geared motor drive. This machine is rated at 70 to 80 headed blanks per minute. Weight 26,875 lbs.

HEADERS
TRIMMERS
POINTERS
THREADERS
SLOTTERS
NUT MACHINES
RIVET DRILLERS
ETC.



½-inch Automatic Nut Forming Machine with geared motor drive. Makes double chamfered nut blanks from cold drawn wire, 80 per minute. Weight 37,300 lbs.

WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

Home Office and Works:
Bank and Meadow Sts., Waterbury, Conn.

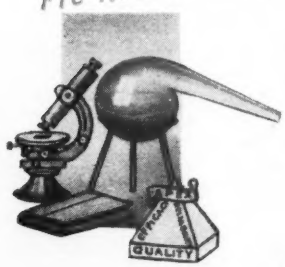
Sales Offices:
Cleveland, Chicago, Newark, N. J.

WHY BE SATISFIED with anything LESS than . . .

. . a ONE-BATH WIRE COATING COMPOUND!

COSTLY and lengthy wire drawing processes are eliminated with Apex PIC-KLEEN, the *only* coating compound that chemically cleans as it coats . . . all in one operation. One bath is all that is necessary when you use PIC-KLEEN . . . a distinct advantage over all other wire drawing compounds that usually require at least two separate baths.

TRY PIC-KLEEN AND COMPARE! PIC-KLEEN will save you TIME and MONEY



An Apex field engineer will gladly call to discuss the particular advantages of PIC-KLEEN in terms of your own requirements.

* * *

Look us up at the Wire Convention in Pittsburgh . . . William Penn Hotel, October 16-19.

DO YOU WANT TO:

- ☆ Clean wire and coat it in one bath
- ☆ Eliminate lime and its many disadvantages in wire drawing
- ☆ Cut your cost as much as 40%
- ☆ Prevent rusting of rods and wire in coils and bundles
- ☆ Use a compound that lubricates and acts as carrying agent for any other lubricant in subsequent drawing
- ☆ Benefit by a compound that neutralizes any unrinsed pickle acid
- ☆ Save with a compound that's faster and gives better wire

PHONE, WRITE OR WIRE TO

APEX ALKALI PRODUCTS CO.

MAIN & RECTOR STS., PHILADELPHIA 27, PA. • *'Phone MANayunk 0969*

A NEW DEVELOPMENT IN METAL STRIPPING

Safer, More Efficient than Former Methods

When a layer of one metal is to be removed from the surface of another metal, the problems involved are usually specific to each case. For example, the removal of copper from mild steel is a different problem from that of removing a layer of copper from alloy steel.

The advantages of Actalyte No. 2 in the removal of metal coatings from other metals are:

(a)—Speed of removal
(b)—Extent of attack on basis metal
(c)—Non-use of electricity

Some of the common procedures used for the removal of copper coatings are rapid, economical, and, under proper conditions, satisfactory. If not properly carried out, however, they may result in either slow removal or in objectionable attack on the basis metal. Again, chemicals required in some of these stripping processes are difficult if not impossible to obtain under present-day conditions. The best example of this is chromic acid which is both costly and difficult to obtain.

This was the condition found to exist in 1943 when the ACP Cuprodine Process was so widely used in drawing small caliber steel cartridge cases. The unsatisfactory status of metal stripping technology led the American Chemical Paint Company to devote considerable time to research on the problem of developing a method of removing copper coatings from steel which would be free from the objections of processes then in use and utilize chemicals that were readily available. In addition to this, there was interest in removal of lead, zinc and cadmium coatings from steel, nickel, chromium and aluminum.

The result of this investigation was the development of ACP Actalyte No. 2. Developed originally to dissolve thin coatings of copper from steel, this new process was found to have the ability to dissolve very thick coatings of copper (in some cases up to ¾ of an inch thick) from steel without undue attack on the basis metal.

In addition to this, Actalyte No. 2 may be used to remove coatings of lead, and, under certain conditions, to remove coatings of zinc and cadmium from basis metals such as iron, aluminum, nickel, chromium, tin and silver.

The stripping bath is prepared by diluting Actalyte No. 2 with water and diluted sulfuric acid until a *p*H of 4 is reached. Two titrations, easily carried out under plant conditions, indicate the amount of Actalyte No. 2 or diluted acid which should be added to the bath to maintain efficient action.

This metal stripping bath can be used as a dip or, if it is desired to remove layers of metals from the interior of machine parts, such as interior of propeller blades, etc., the solution can be pumped from a reservoir tank through the part in question.

Mild steel equipment is satisfactory. The solution can be used at room temperature or, to increase the rate of metal solution, the temperature can be increased to as much as 130 degrees F.

Complete conditions for use of ACP Metal Stripping Solution—Actalyte No. 2—are contained in Technical Service Data Sheet No. 13-14-2-2 issued by the American Chemical Paint Company, Ambler, Pa.

When Dies *TALK!*

Dies can tell a surprising story on proper lubrication for drawing and how the life span of dies is affected thereby.

Soaps, lime, grease, oils, etc., used to facilitate drawing, are effective principally because of their lubricating characteristics.

Cuprodine, on the other hand, is more than a lubricant—it reacts with the tiny irregular points on the steel surface dissolving such minute quantities of the surface as are necessary to form a thin, adherent copper coating.

A Cuprodine coating leaves no sharp points to push through the coating and scratch the walls of the die, nor are there tiny points left that heat sufficiently to weld to the die with the result that either die or work tears out.

Insure longer die life and better drawing

Cuprodize with Cuprodine

Manufacturers of Inhibitors & Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

Note: West Coast Plants may address inquiries and orders for prompt delivery to Leon Finch, Ltd., 728 East 59th St., Los Angeles, Calif.

American Chemical Paint Co., Ambler, Pa.
Please send me general Technical Service Data Sheets on
☐ CUPRODINE ☐ ACTALYTE
Name_____ Title_____
Company_____
Address_____
D-10

SHAPED WIRE FOR MANY NEEDS

FROM COTTER PINS TO---

★ Wire drawn to special shapes has an important place in modern production. It adds to the utility and appearance of many products, cuts manufacturing costs, and frequently saves valuable production time.

Continental offers a special service in shaped wire. Continental wire, to fit particular needs, can be supplied to manufacturer's specifications in a wide variety of shapes, sizes, and tempers (no cross-sectional dimension to be greater than ½ inch). Many different finishes and coatings also available.

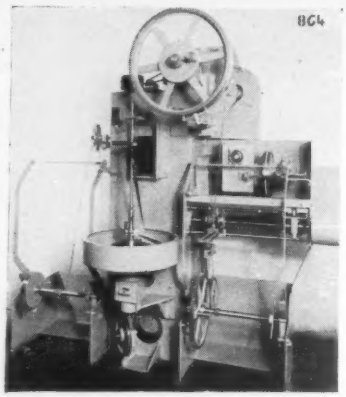
If you have use for shaped wire, you are invited to take advantage of Continental's experience in developing manufacturers' wire for special jobs. Write or wire today.

CONTINENTAL STEEL CORPORATION, KOKOMO, INDIANA

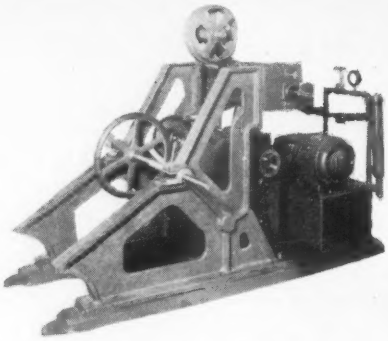
(The Superior Sheet Steel Co., Canton, Ohio—A subsidiary)

CONTINENTAL
STEEL CORPORATION

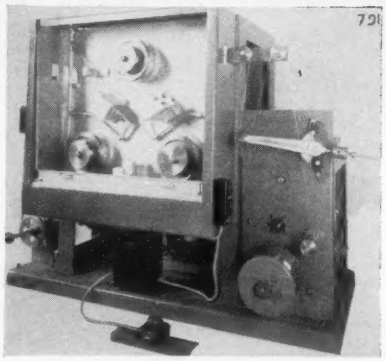
PRODUCERS OF— **SHEETS: Black, Galvanized, Copperior, Hot and Cold Rolled, Special Coated, Long Terne, etc.**
WIRE: Bright Basic, Annealed, KONIK, Coppered, Tinned, Special Manufacturer's, etc.
Nails, Staples, All styles of fence, Gates, Steel Roofing, other steel products.



TAPING MACHINE for Varnished Cambric and other tapes. Pads of tape are concentric mounted on dynamically balanced reversible head, arranged to give constant tape tension. Welded steel frame, ball-bearing mounted, adjusable traverse on take-up and motor drive.



Take-up Reel-stand, Motor Drive, Ball-bearings, Tension Hydraulically controlled and Variator for regulation of Traverse Rate.

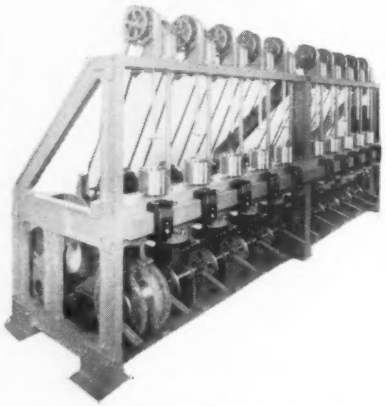


HIGH SPEED
WIRE DRAWING MACHINE
for Intermediate and Fine Wire.
Ball-bearings and Motor drive.

EST. 1855 INC. 1915

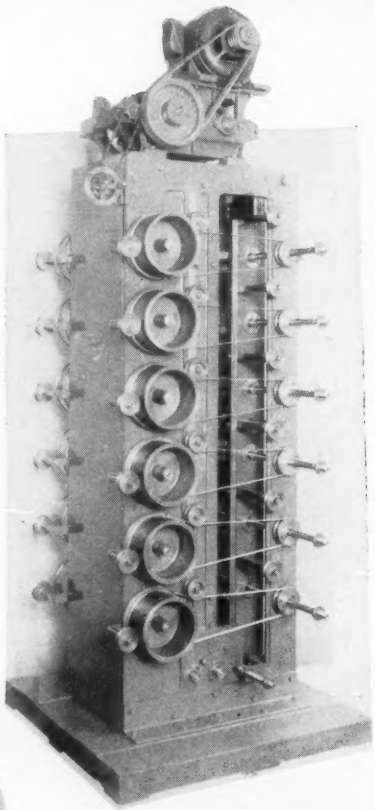
"American"
INSULATING
MACHINERY
COMPANY

517 West Huntingdon St.
Zone 33
PHILADELPHIA PENNSYLVANIA U.S.A.

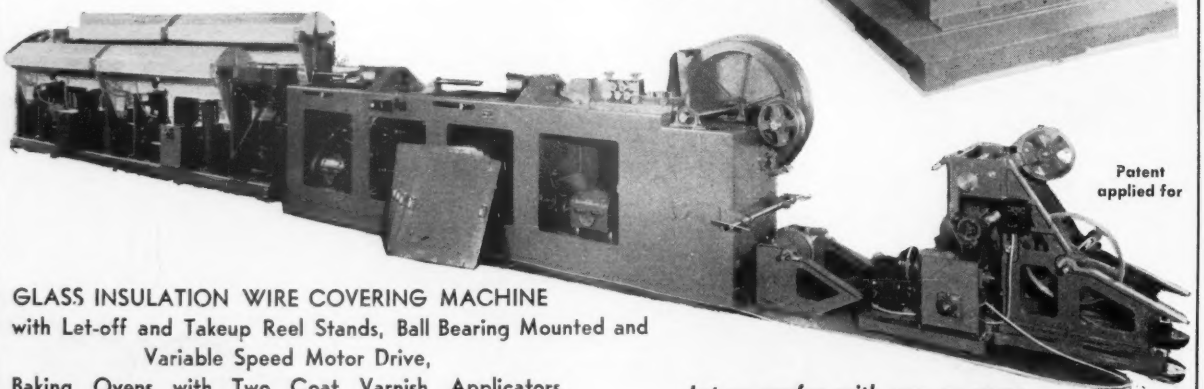


MODEL 2S10-MBB MACHINE
High Speed, Ball Bearing,
Each Unit Individually
Motor Driven
For Application of All
Types of Insulation
Spirally Wound

COMPLETE
LINE OF
WIRE INSULATION
WINDING MACHINES



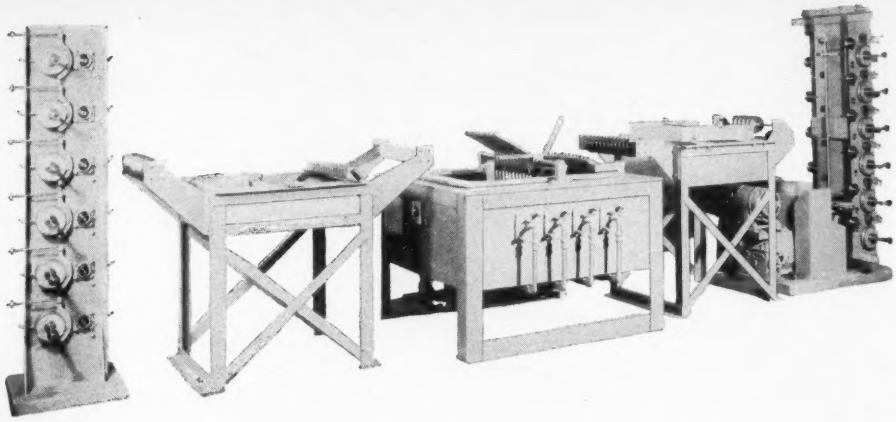
VERTICAL MULTIPLE WIRE PULLOUT with Slip Friction Takeups and Speed Variator for Tinning, and Annealing Processes, etc. Ball Bearing Mounted and Motor Driven.



Patent applied for

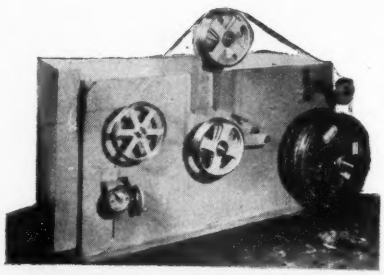
GLASS INSULATION WIRE COVERING MACHINE
with Let-off and Takeup Reel Stands, Ball Bearing Mounted and Variable Speed Motor Drive,
Baking Ovens with Two Coat Varnish Applicators, and Individual Automatic Temperature Controllers.

Let us confer with you on your wire machinery problems.



WIRE TINNING OUTFITS

Horizontal Takeups and Let-offs supplied for larger size wires and accommodating large reels.



A compact Take-up for Wire, Synthetic Cords, etc., for use in connection with Extrusion Machine, or process operations, etc.

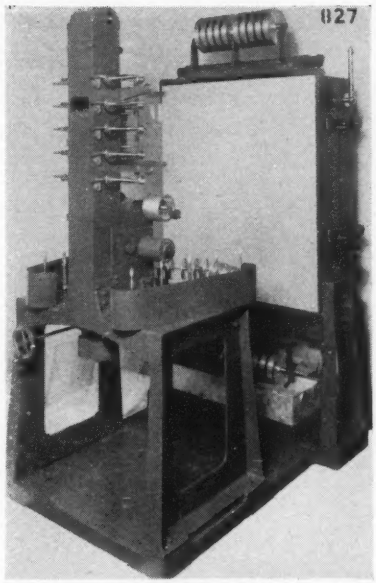
Reel Speed synchronized hydraulically, Constant Speed Capstan and Adjustable Constant Tension with Adjustable Traverse, Welded Frame, Ball-Bearing throughout and built-in Motor Drive.

EST. 1855 INC. 1915

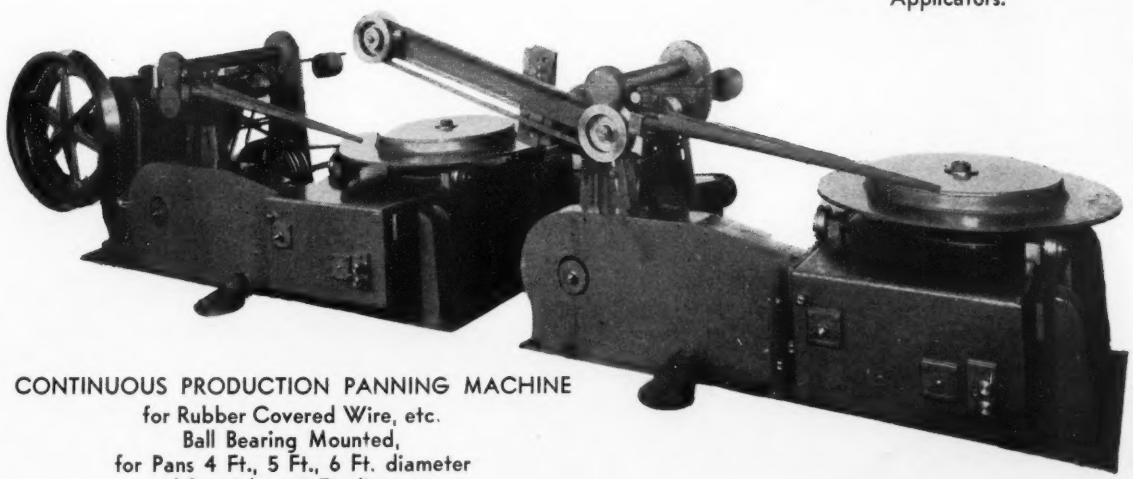
"American" INSULATING MACHINERY COMPANY

517 West Huntingdon St.
Zone 33
PHILADELPHIA PENNSYLVANIA U.S.A.

FULL LINE OF WIRE ENAMELING MACHINES



M-10 Fine Wire Enameling Machine, Ball-bearings and Motor Drive. Other models for heavier wires. Lacquering Outfits and Synthetic Applicators.



CONTINUOUS PRODUCTION PANNING MACHINE
for Rubber Covered Wire, etc.
Ball Bearing Mounted,
for Pans 4 Ft., 5 Ft., 6 Ft. diameter
and Special to 10 Ft. diameter

FIDELITY Wire-Spooling Systems

for production speed and smooth lay ★ ★ ★

There are a dozen types of FIDELITY Wire-Spooling Machines to take care of wire from 16 gauge B&S to diameters as low as .0015".

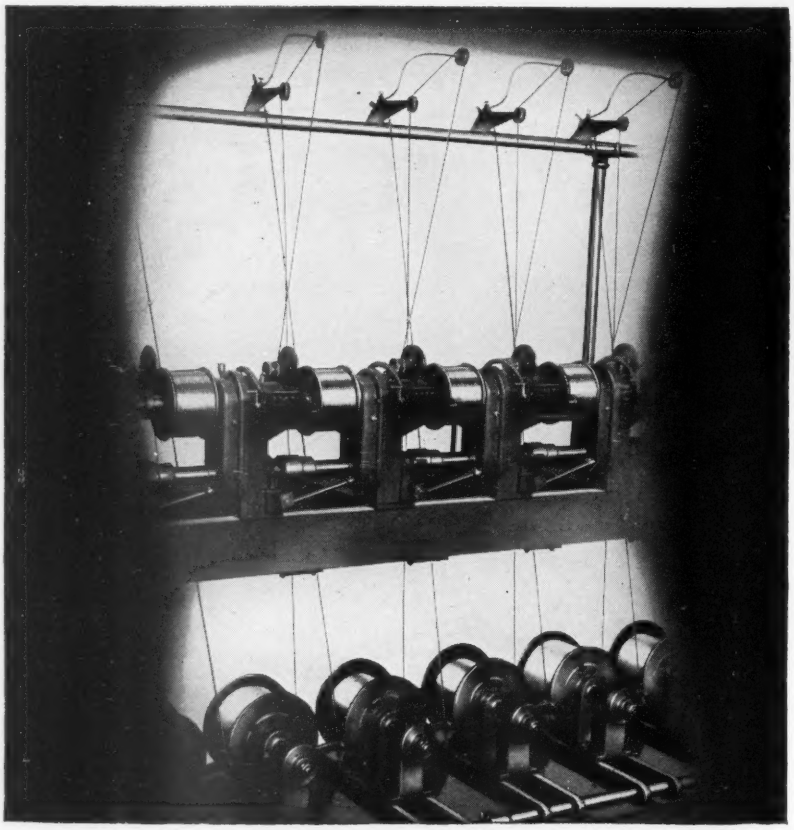
Each gives you accurate winding and uniform lay. Simple to operate, variable speed and traverse, readily adjustable to different size spools, can be equipped with stop motions and brakes to prevent over-running. They may be had to wind from spools, reels or coils or, in some cases, directly from production machines or annealing furnaces. Available in single or multiple units.

Whether you wind large or small spools, sticks or quills, fine or coarse wire in single or multiple ends, you will find FIDELITY Wire Spoolers adaptable, adjustable, economical.

For war- or peace-time production, you gain by the multiple advantages from FIDELITY Wire-Spooling Systems. Used by electrical and mechanical equipment manufacturers throughout the country.

Write for special bulletin.

★ ★ ★



Close-up of four sections of a 12-Head FIDELITY Spooling Machine with screw traverse, tension compensators, stop motion, yardage counters, variable speed, individual clutches and many other time- and labor-saving devices.

★ ★ ★

To Hasten Peace, Buy More Bonds

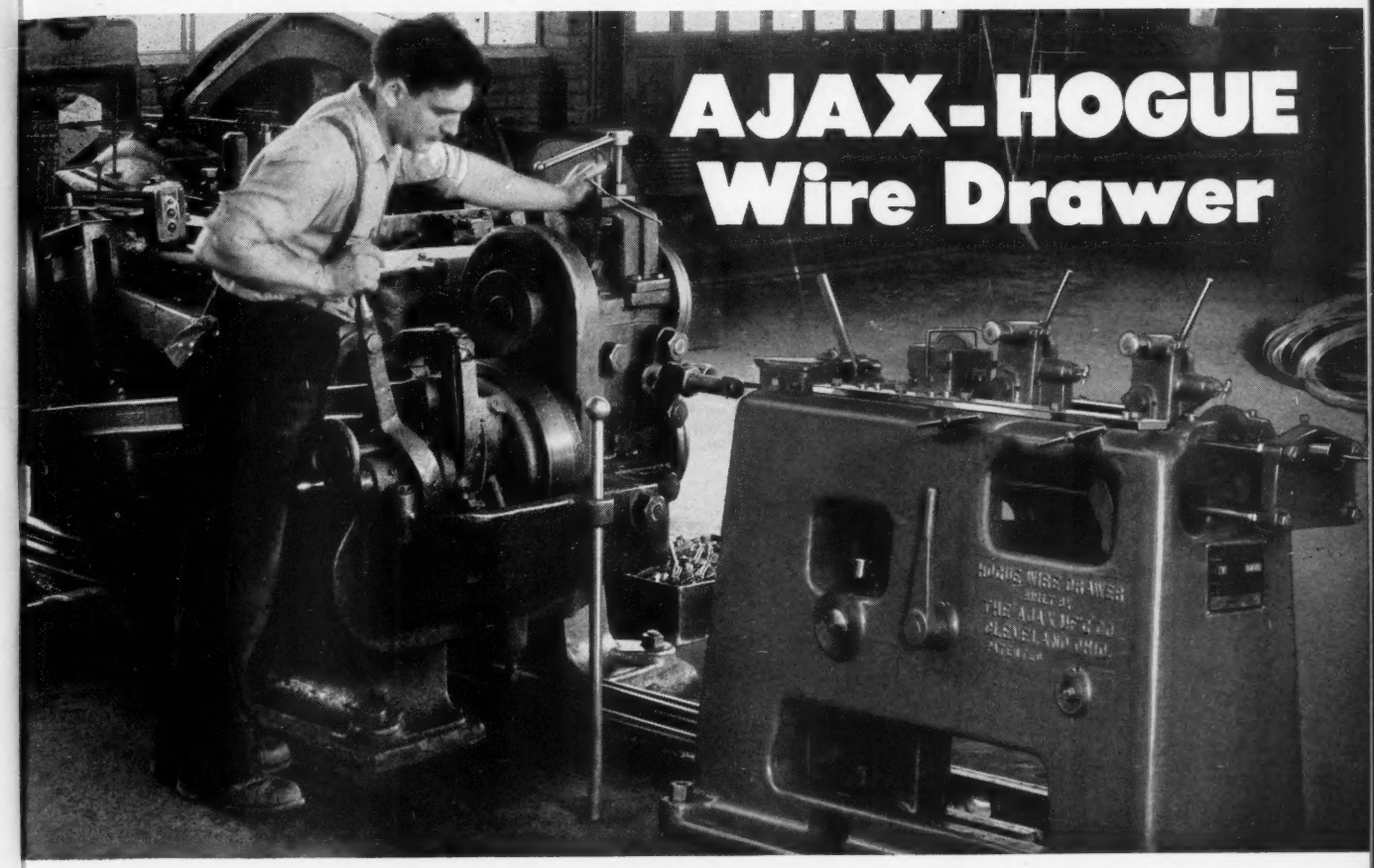
Makers of Automatic Precision Machines

FIDELITY
MACHINE COMPANY

★

3908-18 FRANKFORD AVE., PHILADELPHIA 24, PA.

This Attachment for Cold Headers



Lowers Material and Heading Die Costs... Steps up Quality and Accuracy

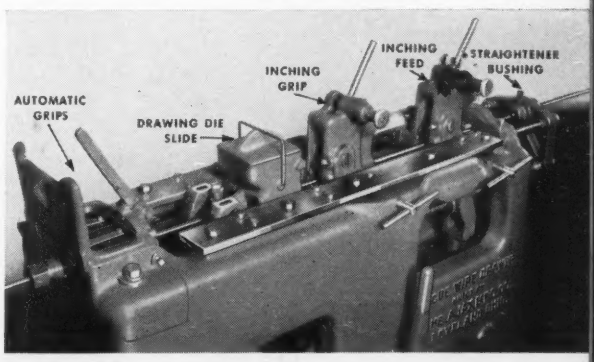
The Ajax-Hogue Wire Drawer makes it possible to produce highest quality cold headed products from less costly hot-rolled stock instead of cold drawn wire.

Header die life is greatly increased, especially on close specification products, due to the clean, straight, accurate wire freshly drawn from hot rolled, pickled and limed rod, and fed into the header dies immediately after drawing.

In the smaller wire diameters, commercial drawn wire is redrawn for diameter accuracy and straightness when heading many Class 3 products, for uniformity of finished product with better die life.

Write for Bulletin No. 111

The Ajax-Hogue Wire Drawer can help you cut heading costs and improve your close tolerance headed products.



THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND, OHIO
621 MARQUETTE BUILDING • CHICAGO, ILLINOIS

"Steelskin Brands"

Reg. U. S. Pat. Office

WIRE, TUBING, STAMPING
DEEP DRAWING SOAPS AND COMPOUNDS

✦ ✦ ✦ ✦ ✦ ✦

ANNOUNCE:

NEW METALLIC SOAPS
AND — COMPLETION OF A NEW BUILDING
TO MEET THE DEMAND FOR THESE
NEW METALLIC SOAPS

★ **"STEELSKIN" KZ,** WIRE DRAWING SOAP POWDER FOR HIGH CARBON AND ALLOY WIRE AT HIGHER CONTINUOUS SPEEDS, CONTINUOUS DRAWING OF UNLIMED OR LIMED GALVANIZED WIRE ONE OR MORE HOLES DRY, FOLLOWED BY WET CONTINUOUS DRAWING, GIVES EXCEPTIONAL SPEEDS AND **INCREASED DIE LIFE.**

★ **"STEELSKIN" CH,** WIRE DRAWING SOAP POWDER FOR STAINLESS STEEL — EITHER OXIDE COATED AND LIMED — OR LIMED ONLY. AND ALSO FOR OTHER DIFFICULT DRAWING.

Back of the **"STEELSKIN" TRADE MARK** is a Thirty-Five Year Period of Experience in the Development and Manufacture of **Soaps and Compounds** For Dry and Wet Drawing of all Types of Ferrous and NonFerrous Wire.

Our Engineers Will Be Glad to Co-operate With You in Finding the Most Economical and Efficient Solution to Your Drawing Problems.

R. H. MILLER COMPANY

HOMER, NEW YORK

Established 35 Years

Vinylite

TRADE-MARK

You Can't Submerge Dependability

THOSE SUBMERGED CABLES mean light and communication to the deep sea diver—and their efficiency depends on water-resistant insulation. They typify the exacting service for which VINYLITE plastic wire and cable insulation is exceptionally well suited. It retains its excellent electrical characteristics though immersed in salt or fresh water during long periods.

Besides its high water resistance, VINYLITE plastic insulation gives the electrical field the advantages of unusual resistance to oils, grease, alkalies, chemical fumes, abrasion, and the deteriorating action of air and sunlight. It remains flexible at low temperatures. It can be made in a wide variety of colors. Certain types are non-flammable, others are slow-burning. Their thin-wall construction and high dielectric strength permit a greater number of circuits in existing conduits.

At present, VINYLITE plastic insulation is allocated 100 per cent to essential applications. When made available for general use, it will bring new reliability and service life wherever its water resistance or other properties are needed by public utilities, industrial and construction concerns, and marine, automotive, and aircraft manufacturers. Booklet VR describes VINYLITE resin compounds for wire and cable insulation and shows their advantages for specific uses. Write Department 17 for your copy.

Plastics Division
CARBIDE AND CARBON CHEMICALS CORPORATION
Unit of Union Carbide and Carbon Corporation

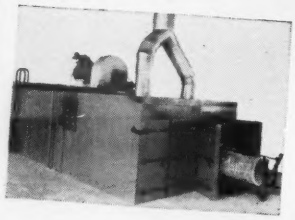
UCC

30 EAST 42ND STREET, NEW YORK 17, N.Y.

Plastics

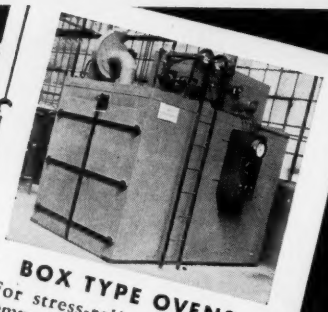
FLASH BAKERS

31 wire mills are now using 59 Morrison Flash Bakers. Baking time is only a few minutes and floor space required for each baker is reduced to the size of a lime tank.



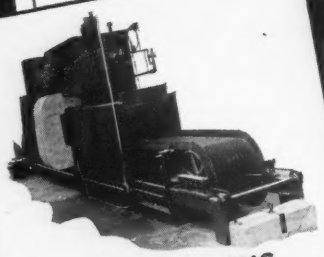
TRUCK TYPE ROD BAKERS

For fine wire, many mills still prefer this modern recirculating type wire baker developed by Morrison. Engineered to meet your specific needs.



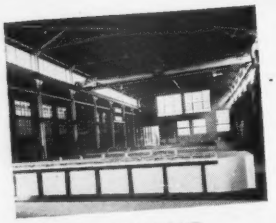
BOX TYPE OVENS

For stress-relieving, spring tempering, paint baking or any operation requiring the application of uniform temperatures up to 700°F. Continuous automatic ovens are available where production warrants their installation.



STRESS RELIEVING AND DRAW FURNACES

This continuous recirculating type furnace can be used for stress relieving, spring tempering, drawing or bluing of any part requiring a uniform temperature not over 900°F.

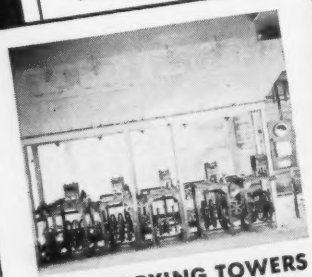


GALVANIZING FURNACES

Morrison convection heated galvanizing furnaces are available to the wire industry either as individual units, or as components of completely engineered galvanizing lines including pay-off, pickling, fluxing, etc.

WELDING ROD OVENS

In addition to high-speed welding rod ovens, Morrison offers equipment for a complete welding rod plant consisting of rod feeders, extrusion presses, dies, grip strippers, etc.



CABLE DRYING TOWERS

High speed lacquering of insulated wire and cable was pioneered by Morrison. We can provide complete installations consisting of pay-off reels, lacquering or saturating equipment and constant-speed, constant-tension wind up machines for wire cable and other continuous strand materials.

EQUIPMENT *for the* WIRE INDUSTRY

Whether it be patenting, annealing or oil tempering furnaces, pay-off reels and take-up units, or the installation of a complete cleaning house—you can save time and money by consulting our engineering department on your wire processing problems.

MORRISON ENGINEERED

MORRISON ENGINEERING CORPORATION
5005 EUCLID AVENUE . . CLEVELAND, OHIO

Associate Companies: MORRISON ENGINEERING OF CANADA, LTD. TORONTO, ONTARIO
CARRIER ENGINEERING CO., LTD. LONDON, ENGLAND

THE EASY-TO-CLEAN DRAWING COMPOUND WITH THE HIGH SOAP-FAT CONTENT

Shelldraw

• Here is a group of outstanding soluble pastes that are removed merely by the use of a warm, light alkaline wash. No inflammable solvents are required.

The high soap-fat content of Shelldraw Compounds assures you of getting useful lubricity and metal protection in every pound.

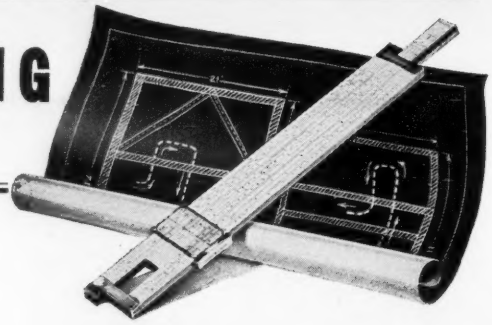
Made from high-quality ingredients and carefully controlled in manufacture, Shelldraw Compounds have the additional advantages of being stable in storage and in emulsion, non-irritating to skin, clean in appearance with a slight, pleasant odor.

Don't wait for drawing troubles to prod you into finding out about Shelldraw Compounds. Call in an experienced Shell Lubrication Engineer now. Have him look over your set-up and make his unbiased recommendations. There's no obligation.

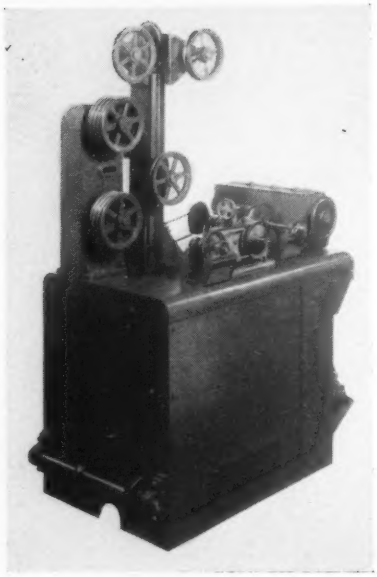
SHELL OIL COMPANY
INCORPORATED

SHELL

OVEN ENGINEERING NEWS



Speed Increased, Finish Improved, Attendant Labor Cut to Minimum By IOE Cable Lacquering System



IOE coating and impregnating systems for wire, cable and allied products have brought about a decided improvement in the standards of the industry. They are now operating in leading plants throughout the United States, producing beautifully finished wire at speeds from 3 to 5 times faster than those of previous equipment. Not only surface finish but dielectric strength and cross sectional accuracy are distinctly superior.

Each **IOE** unit is compact and easy to operate, with readily accessible lacquer and saturation pots, quickly changed unwind stands and high-speed constant-tension takeup machines. Result: under normal conditions **one man can handle an 8-end system producing 48,000 lineal feet of medium size cable per hour!**

Takeup Units

These high-speed constant-tension takeups, complete and self contained, are made in standard sizes with a wide range of speed and tension. Their adjustable wire lay gives them extreme flexibility, and they are adaptable for many different materials.

Saturation Pots

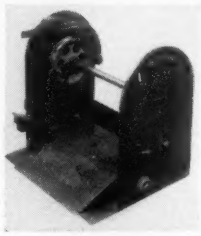
Saturation pots of remarkably advanced design are included in all **IOE** systems. These are supplied for any number of immersions from 3 to 25, hold thin saturants, and are equipped for pressure feed and quick draining. They are completely accessible and easily threadable.

Lacquer Pots

IOE lacquer pots are designed for single or multi-pass lacquering, and are furnished in single-pass, standard for saturation, and 5- and 6-pass, standard for lacquering. They are made of cast aluminum or iron in three standard sizes, equipped with optional pressure feed, lower seal control and wiper control.

Their use assures 100 percent coverage of braid, while positive wiping eliminates excessive lacquer coating.

Payoff Stands



The payoff stands used are equally efficient, affording controlled tension at all times and thereby eliminating backlash. They are foot-pedal loaded, the operator simply rolling the reel into position and stepping on a foot pedal which simultaneously raises the reel and sets a counter-weighted tension brake.

Drying Tower

The principal unit of the system is a highly efficient explosion-proof vertical oven, designed to produce an extremely high gloss finish with absolute safety. It can be heated by electricity, gas, oil or steam, and maximum recirculation of atmospheres is attained despite the extreme volatility of the impregnants and lacquers used. All such oven towers are completely accessible and are adapted to existing buildings without inconvenience to the user.

Note: IOE *lacquer systems are also applicable to finishing of coated cords, fishlines, tapes, coated filaments and fibers.*

GET COMPLETE DATA

This page gives only a bare outline of **IOE** cable lacquering equipment. For full information, send for a free copy of "Lacquering of Insulated Wire and Cable", a 16-page reprint of our authoritative article in **Wire and Wire Products.**

(This is No. 16 of a series. Reprints of previous advertisements will be sent free upon request.)

ENGINEERING VERSATILITY

THE INDUSTRIAL *Oven Engineering* COMPANY

11621 DETROIT AVE., CLEVELAND 2, OHIO

Engineering Representatives in Principal Industrial Areas

★ **ASSOCIATED COMPANY: JAMES DAY MACHINERY LTD., LONDON, W. 1, ENGLAND** ★

MEAKER PROCESS
for
Electro-Galvanizing
WIRE

PREFERRED FOR THESE REASONS:

Any coating weight desired
Heavy coatings (up to 3 oz.)
Light coatings (0.1 oz. or less)

Uniform coatings
No thin spots
Maximum protection

High or low carbon wire
Meaker process does not affect physical properties

Perfect adhesion
Even with heavy coatings
No cracks on bending

Drawing after electro-galvanizing
Is easier; no damage to coating; gives long die life

Appearance increases salability
Smooth, dense, non-porous coating
Brightness lasts without burnishing

Simple, pre-tested operation
Requires little skill or experience
No special alloy anodes needed

Economical to operate
Plant-proved design
Long-lived equipment

No royalty — no rental fees

ALL THESE ADVANTAGES WITH NO INCREASE IN COST

THE MEAKER COMPANY

1629-41 South 55th Avenue
CHICAGO 50, ILLINOIS

James L. Entwistle Co.

43 Church St., Pawtucket, R. I.

FOR 26 YEARS

Manufacturers of Spark-Testing Equipment for the production testing of the insulation of Wire, Cable and Cords.

Every improvement in Spark-Testing Equipment and procedure during this period has been introduced by us.

AT PRESENT

Our JLE High-Speed, High-Sensitivity
WIRE SPARKERS

Are the only Wire Sparkers manufactured in the U. S. A. that can be guaranteed to meet the new Navy 15-CI (INT) Specifications, British and Canadian Specifications and any present or future specifications of Underwriters' Laboratories for the Spark-Testing of Insulated Wire.

Improved Nylon Insulating Yarns

To Meet Your Particular Specifications

INTO THE MAKING of these superior nylon yarns, Cheney Brothers have put all the "know-how" of a famous name and a century of textile experience. Precision-wound for today's precision manufacturing, these yarns are supplied in scientifically accurate put-up to meet the needs of each customer. And to customers who desire it—Cheney Brothers also offer a technical service, and laboratory and field research.

Insulating yarns are just one example of the many Cheney products now on the market or in the process of development. All these yarns, fabrics and services are vigorous expressions of the Cheney tradition—and many of them will fit in with your plans for postwar business.

In the meantime, *this* plan will bring Victory sooner: Buy—and keep on buying—War Bonds!

★ CHENEY YARNS

CHENEY BROTHERS

Manufacturers of fabrics of exceptional quality since 1838

Velvets—Pile Fabrics—Upholstery and Decorative Textiles
Cravats—Men's Wear Fabrics
Yarns for Industry—Industrial Textiles—Machine Threads

Sales Offices

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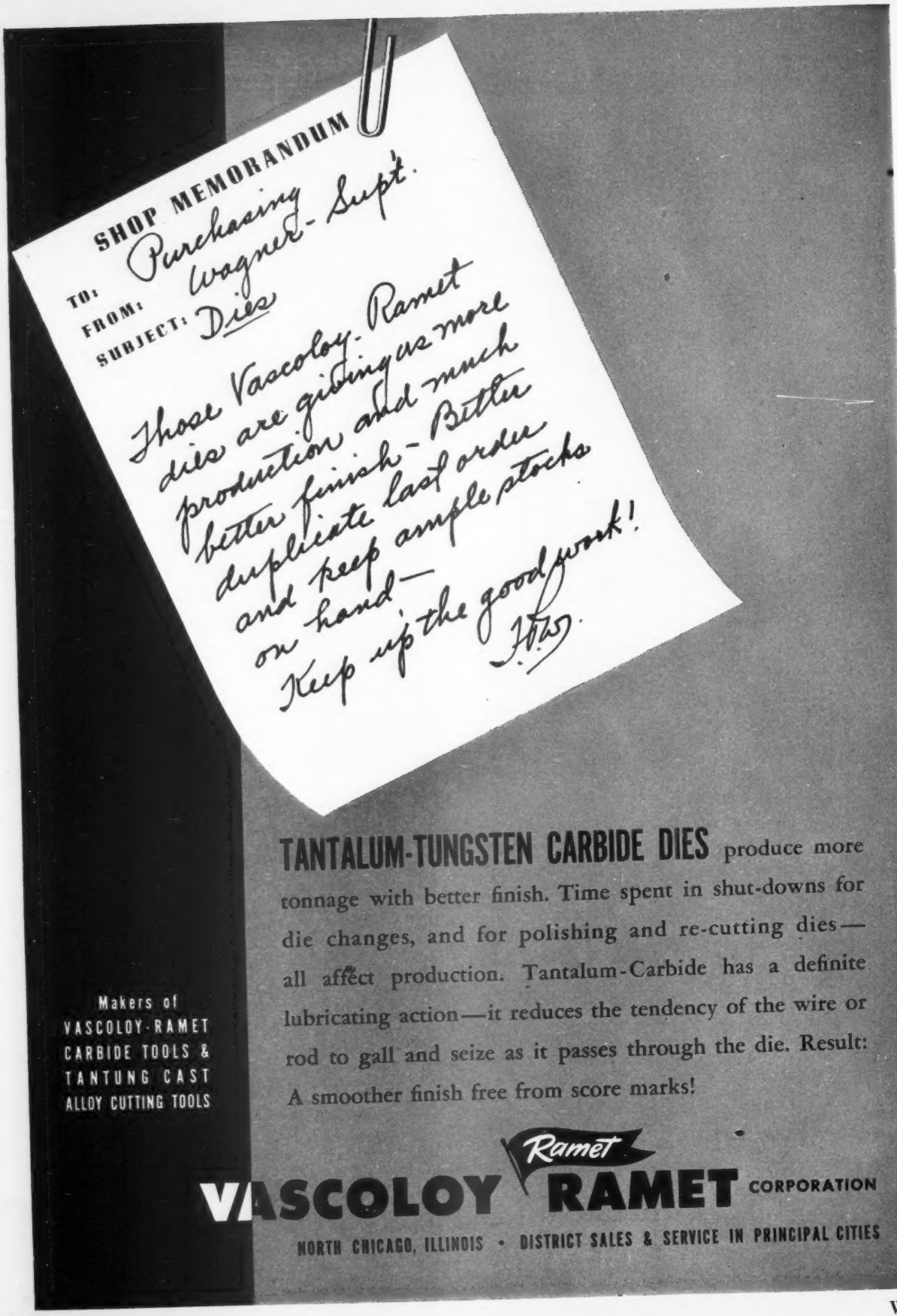
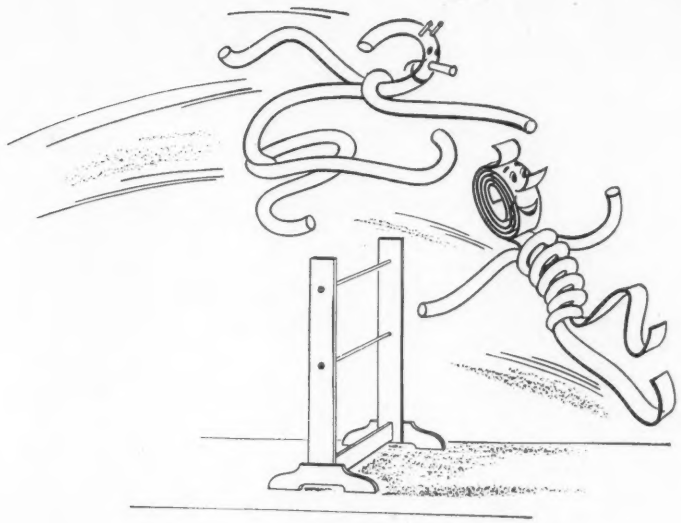
MILLS AT MANCHESTER, CONN.

ALSO AT MANCHESTER, CONNECTICUT, A SUBSIDIARY...PIONEER PARACHUTE COMPANY


SHOP MEMORANDUM
TO: Purchasing
FROM: Wagner - Supt.
SUBJECT: Dies
Those Vascoloy-Ramet dies are giving us more production and much better finish - Better duplicate last order and keep ample stocks on hand—
Keep up the good work!
J.W.S.
TANTALUM-TUNGSTEN CARBIDE DIES produce more tonnage with better finish. Time spent in shut-downs for die changes, and for polishing and re-cutting dies—all affect production. Tantalum-Carbide has a definite lubricating action—it reduces the tendency of the wire or rod to gall and seize as it passes through the die. Result: A smoother finish free from score marks!
Makers of VASCOLOY-RAMET CARBIDE TOOLS & TANTUNG CAST ALLOY CUTTING TOOLS
Ramet
VASCOLOY RAMET CORPORATION
NORTH CHICAGO, ILLINOIS • DISTRICT SALES & SERVICE IN PRINCIPAL CITIES



Let WICK and SPEN hurdle your Steel Wire Problems

Difficult wire problems are sometimes a hurdle in the path of new product development. When faced with such situations many manufacturers consult Wick and Spen whose years of experience have made them expert in hurdling steel wire problems.

When asked to cooperate in the solution of a wire problem our metallurgists first determine the amount of forming and processing to which the wire must be subjected, and the ultimate service requirements of the finished product. Then they establish the carbon content, annealing, cleaning, finishing procedures and laboratory control tests. As a further assurance of quality we make and process our own steel in our own open hearths and modern wire mills.

For over 125 years we've been making high and low carbon steel wire, round and shaped, in a wide variety of sizes, tempers, grades and finishes. Our large volume of repeat business is evidence of the confidence which customers have in products bearing the Wickwire Spencer label, and your assurance of satisfactory service.

A NEW SUBSIDIARY

The Wickwire Spencer Steel Company announces the purchase of the Sirian Wire and Contact Co. of Newark, N. J. and the formation of a new subsidiary—The Wickwire Spencer Metallurgical Corporation. Fine drawn tungsten and molybdenum wire and rods, as well as tungsten carbide dies and tools, will continue to be manufactured.

Send your wire questions to

WICKWIRE SPENCER STEEL COMPANY

500 FIFTH AVENUE, NEW YORK 18, N. Y.

Abilene • Buffalo • Chattanooga • Chicago • Detroit • Houston • Los Angeles • Philadelphia • San Francisco • Tulsa • Worcester

Gilron

Extends Greetings

to the

Members of the Wire Association!

▼ ▼ ▼

GILRON COATINGS FOR WIRE DRAWING

Have proven to be an important contribution to the science of drawing wire and are being used successfully by a number of large mills.

"Gilron" coatings enable wire drawers to operate machines at speeds heretofore considered impracticable and are proving a boon to speeding up production of wire for war purposes, increasing die life, preventing the scratching of wire, eliminating the necessity for lime in many cases and producing a better finish.

This is much to claim, but results in a number of large wire mills substantiate the statements. These coating compounds have been of particular value in the more difficult operatings — drawing stainless, alloy and high carbon wire, and on welding rods. Multiple reductions can be drawn without re-coating.

GILRON COATINGS MAY BE USED FOR DRAWING STAINLESS, HIGH AND LOW CARBON AND COPPER COATED WIRE.

We shall be glad to confer with you on your wire drawing problems and invite you to write or 'phone for particulars.

Gilron Products Company

1559 EAST 40th ST.

CLEVELAND, OHIO

Telephone:
HEnderson 8375

You'll Like "NORTON RESINOID"

for Many of Your Roll Grinding Jobs

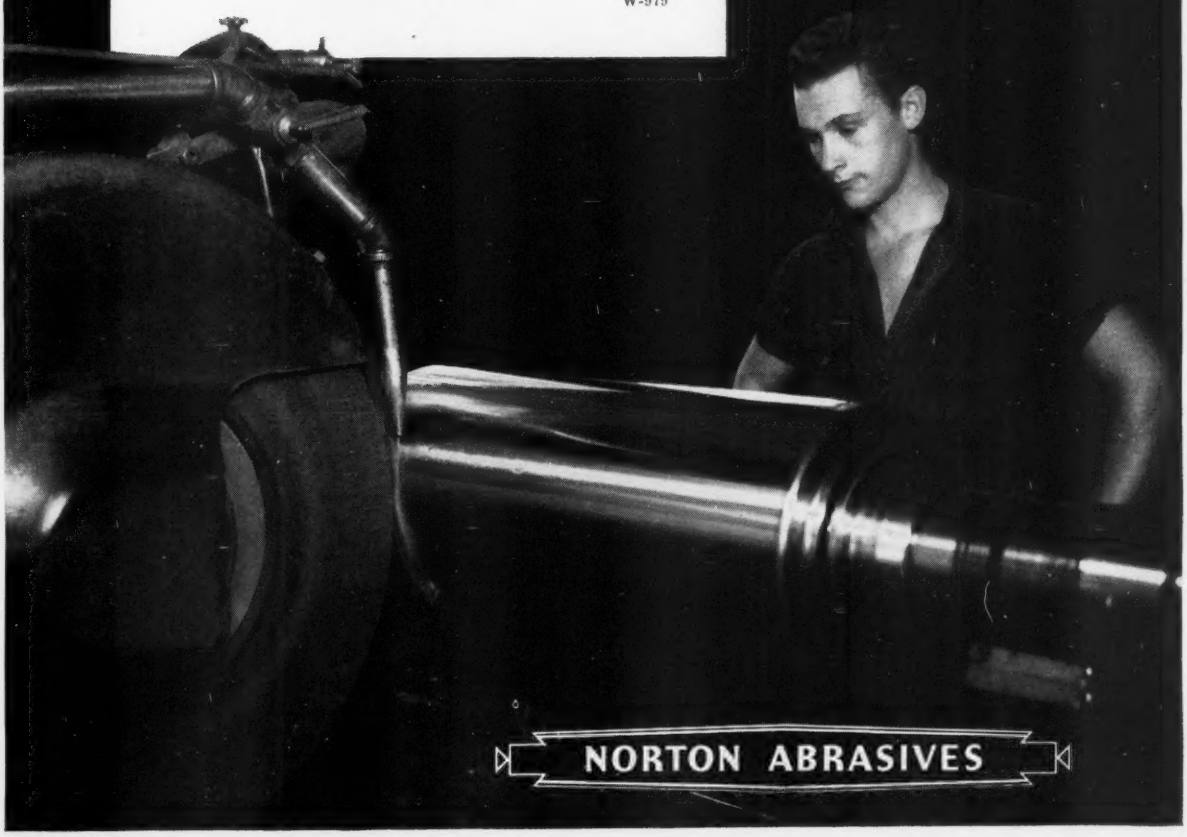
FOR the regrinding of hot mill rolls and for the finish grinding of cold mill rolls Norton resinoid bonded wheels are outstandingly popular. Norton research has developed for each job just the resinoid bond formulas necessary for proper grinding action.

The resinoid wheel for the regrinding of chilled iron hot mill rolls, for example, has a smooth grinding action that produces a chatter-free surface. For the mirror finish on cold mill rolls there are fine grit Norton resinoid wheels — made of Crystolon abrasive for producing a black surface and of Alundum abrasive when a gray color is preferred.

Norton abrasive engineers will be glad to study all of your roll grinding jobs and recommend the proper wheels — whether resinoid, vitrified or shellac bonded; Alundum, 38 Alundum or Crystolon abrasive.

NORTON COMPANY
Worcester 6, Mass.

W-979



NORTON ABRASIVES

A label to Watch for

For your post war requirements where Quality must count--Spencer will furnish Precision Wire from .0001" to .020".

• STAINLESS • BRONZE • STEEL • MONEL • SPECIAL ALLOYS

Spencer Wire Company

WEST BROOKFIELD PLANT

WEST BROOKFIELD — MASSACHUSETTS

U. S. A.

MASTER

TUNGSTEN CARBIDE DIES

Greatly improved TUNGSTEN CARBIDE DIES are now produced by the latest methods under strict laboratory control. Through continuous research Master is able to offer manufacturers new standards of quality and performance in dies. Many improvements have been pioneered by us, some of which are exclusively found in Master dies.

Our research staff is ready at all times to help you solve your production problems and to keep you informed of developments that will add to your production economies. You are cordially invited to avail yourself of this service.

MASTER DIES

Offer you

SUPERIOR QUALITY	●	HIGHEST PRECISION
PROLONGED LIFE	●	EXCLUSIVE FEATURES

MASTER WIRE DIE CORP.

250 East 43rd Street New York 17, N. Y.

Manufacturers of wire, tube, bar, shell, shaped, extrusion and cold heading dies.

J&L WELCOMES THE WIRE AS

E ASSOCIATION TO PITTSBURGH

A sight known to thousands of Pittsburghers is J&L's Pittsburgh Works situated on both banks of Monongahela River "Victory Valley." The Golden Triangle or downtown section is in center background.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH, PENNSYLVANIA
MAKERS OF CONTROLLED QUALITY WIRE • LOW CARBON AND HIGH CARBON GRADES • WELDING WIRE • OIL TEMPERED AND ROPE WIRE

J&L STEEL

FURNACE ENGINEERS, INC.

1551 WEST LIBERTY AVENUE
PITTSBURGH 26, PA.

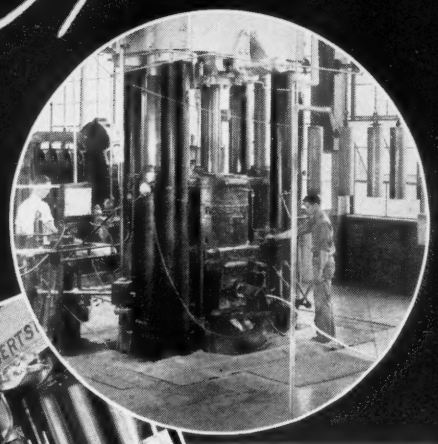
designers and manufacturers of industrial furnaces, offer the wire industry a complete line of heat treating equipment, and experienced engineering service for those who have production problems requiring specially designed equipment.

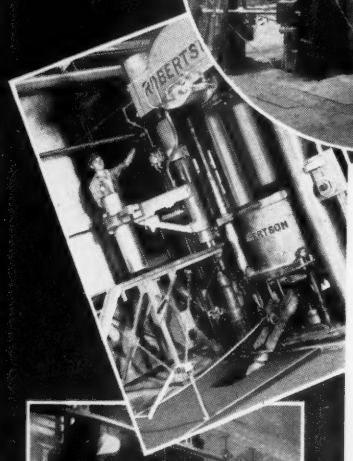
Representatives of the Company will be in attendance at the Wire Association Annual Convention in Pittsburgh in October. You are cordially invited to consult with them on any question involving the heat treatment of rods, wire and wire products.

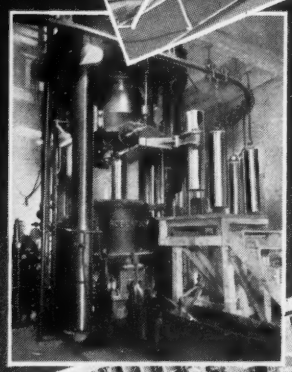
Telephone: Fieldbrook 7727

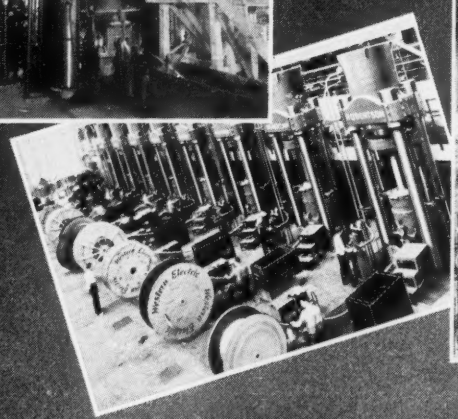
Exclusively

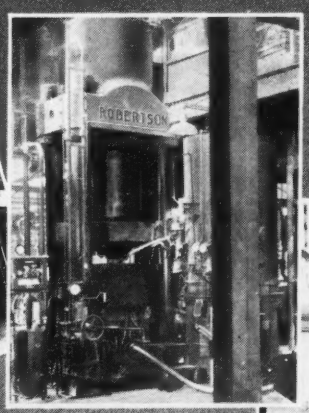
JOHN Robertson
COMPANY, INCORPORATED
125-135 WATER STREET, BROOKLYN 1, NEW YORK

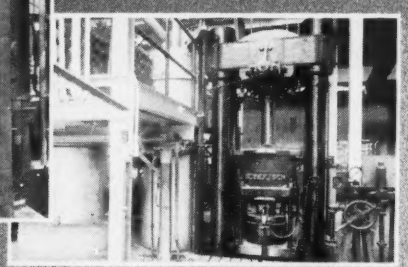












It is a privilege for us to list the following widely known and representative firms, who are users of ROBERTSON LEAD ENCASING PRESSES AND LEAD ENCASING DIE-BLOCKS—*"EXCLUSIVELY:"*

National Electric Products Corp.
Crescent Insulated Wire & Cable Co.
Home Rubber Co.
John A. Roebling's Sons Co.
Phelps Dodge Corp.
Anaconda Wire & Cable Co. Marion plant
Paranite Wire & Cable Co.
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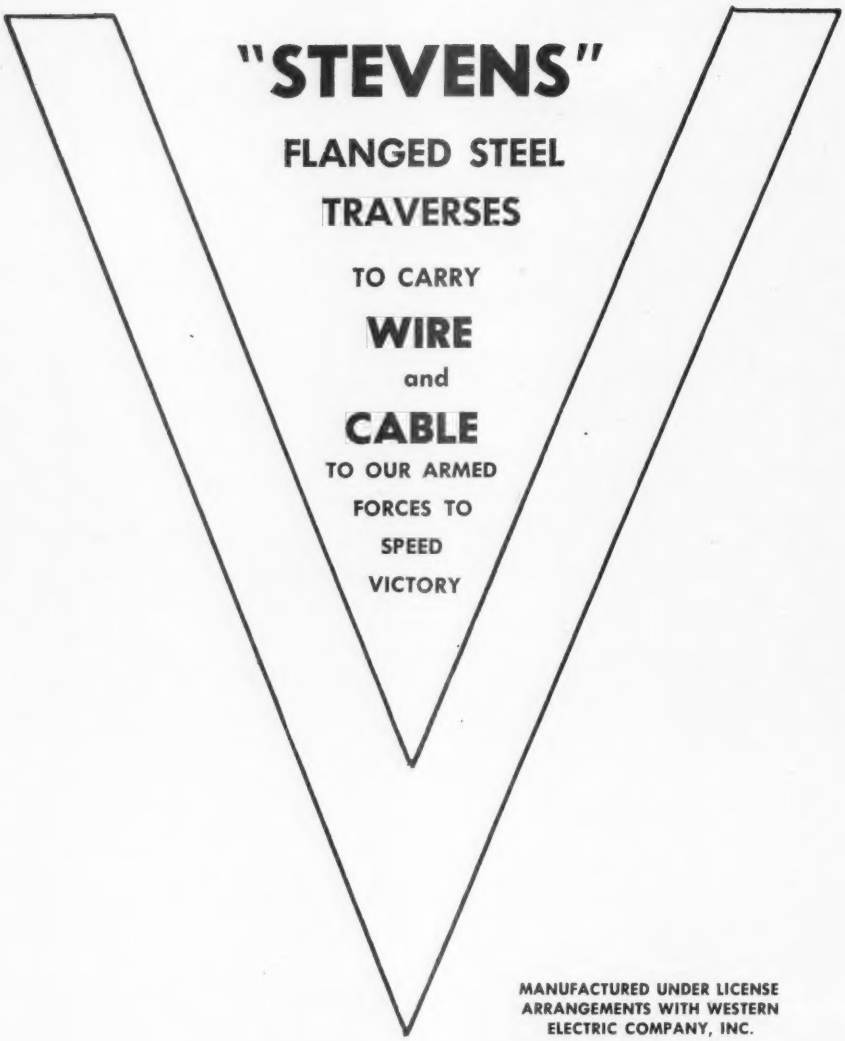

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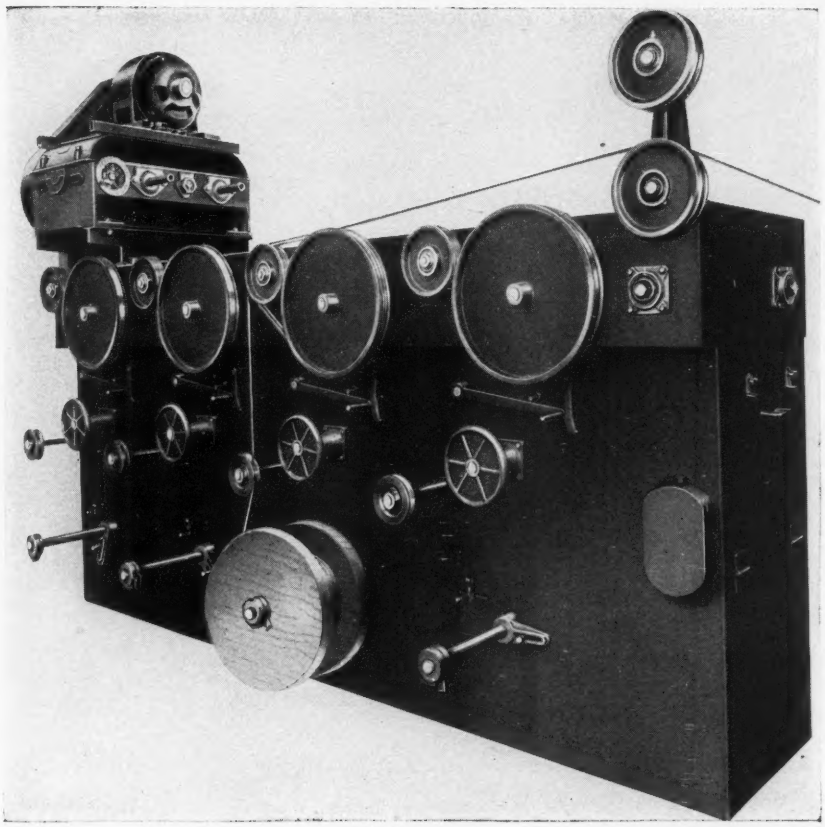
Overhung Spindle Type



The above illustration is a 4-Reel Capstan Take Up, overhung spindle type, as used for reeling weatherproof and tinned copper wire.

This machine consists of four individual take ups, all driven from one motor and a variable speed transmission. All gearing, sprockets, chain and drive shaft are fully guarded.

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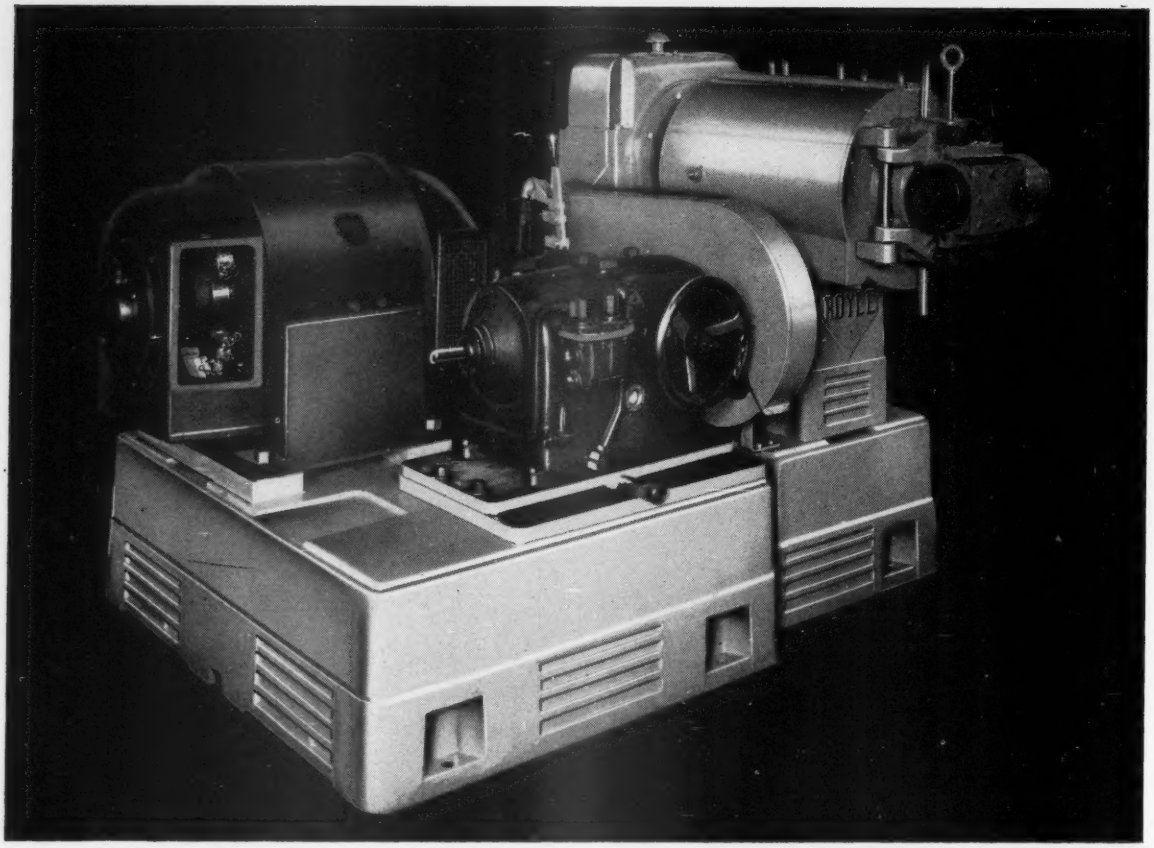

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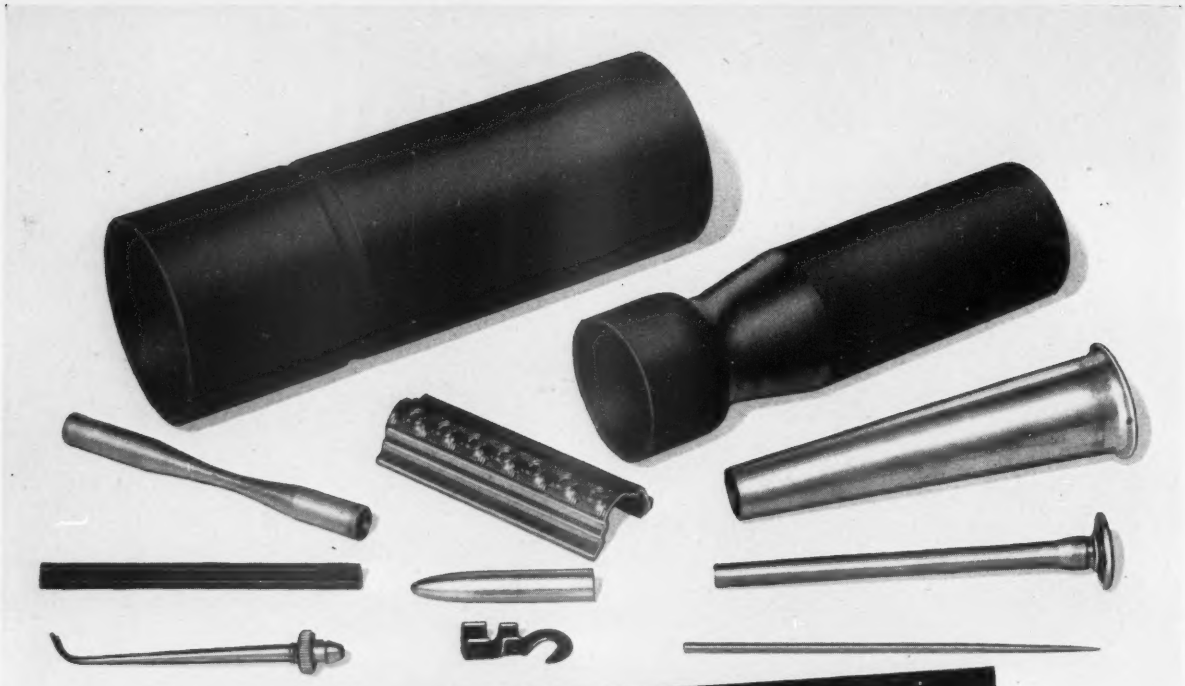

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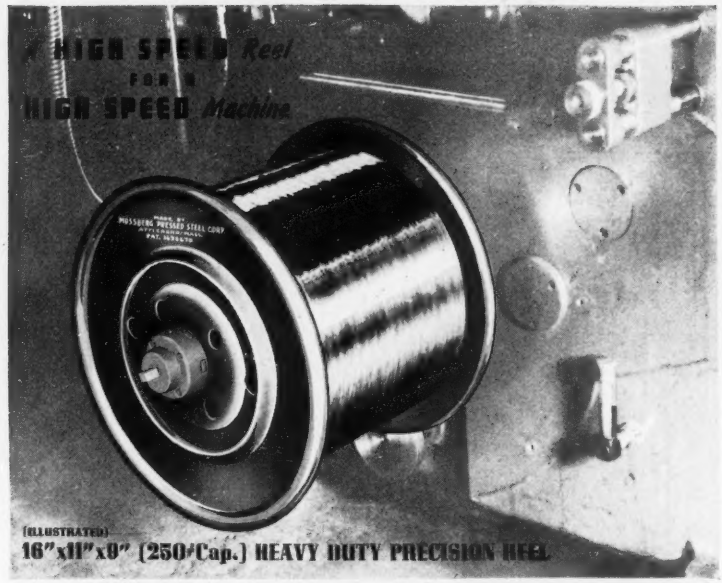

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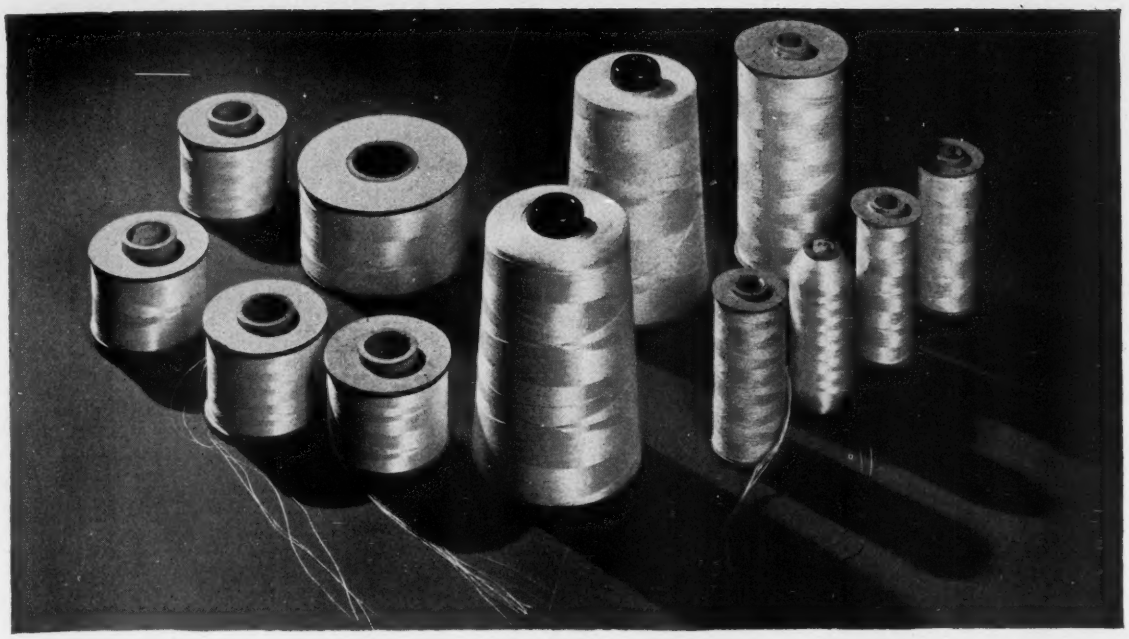

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SPACE FACTOR is extremely good. Typical percentages of copper area to total cross-sectional area of finished wire are 96% for AWG #21 wire, and 95% for #24 wire for CEROC 200 by comparison with only 69% and 59% respectively for other insulations that might be used for high-temperature applications. Moreover, CEROC 200 coating is extremely uniform, thus making for smooth, level winding. The preferred coating thickness is ¼ mil., and the following characteristics are based on wire so coated:

MAXIMUM STABLE TEMPERATURE for continuous operation—200° C.

VOLTAGE BREAKDOWN between two wires of a twisted pair 4" long:

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LEAKAGE between two wires of a twisted pair, 4" long, at 95% relative humidity is greater than 100,000 megohms.

FLEXIBILITY by bending: 16% elongation.

ABRASION RESISTANCE: Average 16-18 scrapes at 200 G. weight on G.E. abrasion tester for #25 AWG wire having the preferred ¼ mil. coating thickness. On wire sizes smaller than #25, this average is slightly less, and on larger than #25 wire, it is somewhat more.

WIRE SIZES: Although CEROC 200 is constantly being adapted to new uses, the present preferred ranges for coated wire are as follows:

Copper wire—from 3 to 30 mils (#40 to #21 AWG).

Nickel wire—from 1½ to 12 mils (#46 to #28 AWG).

WINDING CHARACTERISTICS: CEROC 200 is sufficiently flexible to present no winding difficulties that will not be far more than compensated for by its tremendous high temperature and space advantages. In general, round coils can be wound satisfactorily by existing methods. Slight modifications in winding technique may prove necessary, however, in the case of rectangular coils or motor armatures.

Although costs on CEROC 200 are being steadily revised downward, as a result of greatly increased facilities, it should be borne in mind that this material was not designed to compete on applications where conventional organic insulations are giving satisfactory service. Rather, it is intended for those applications where a substantially higher temperature insulation combined with space- and weight-saving factors more than justify a somewhat higher price for the CEROC 200 insulation that makes them possible.

SAMPLES

CEROC 200 is by no means a new or untried development. For more than a year, large quantities of CEROC-insulated wire have been supplied for important war applications of the most exacting sort. Thus, although production facilities are being steadily increased, it is still difficult to supply generous samples of specific wire sizes to all who might be interested. As far as possible, however, we will gladly supply small quantities of available sizes to large users who want to test its far-reaching possibilities in connection with their products at a later date when full and prompt deliveries are possible.

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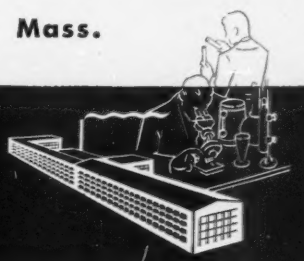

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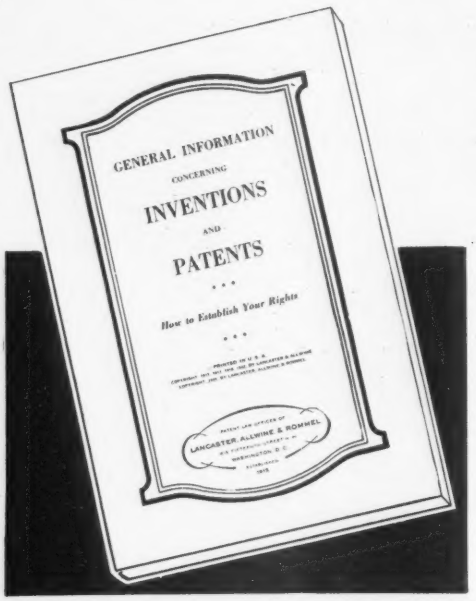

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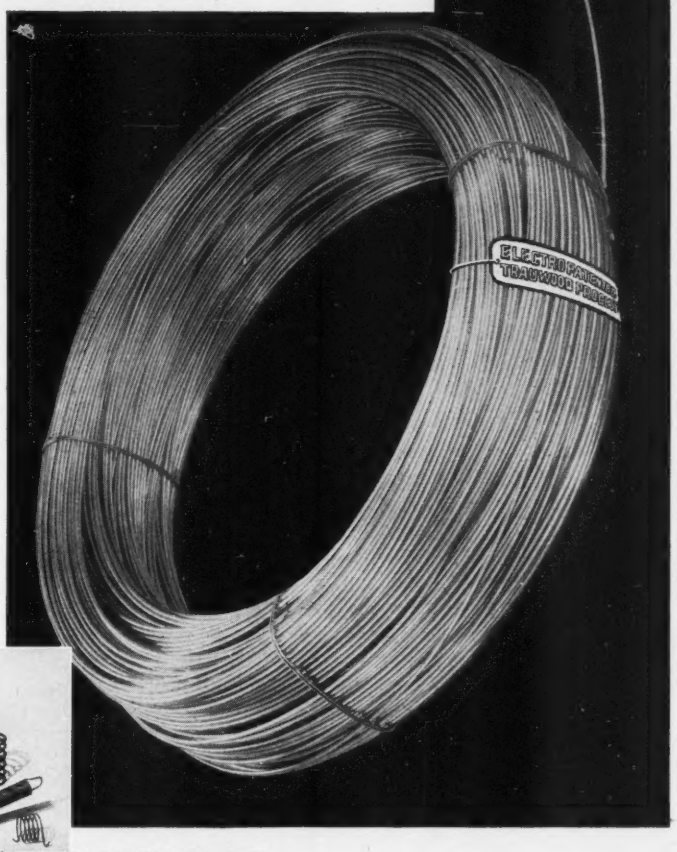

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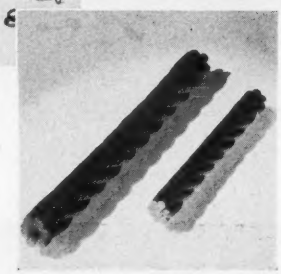

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 19 OCTOBER, 1944 No. 10

Designated as

Official Publication By The Wire Association

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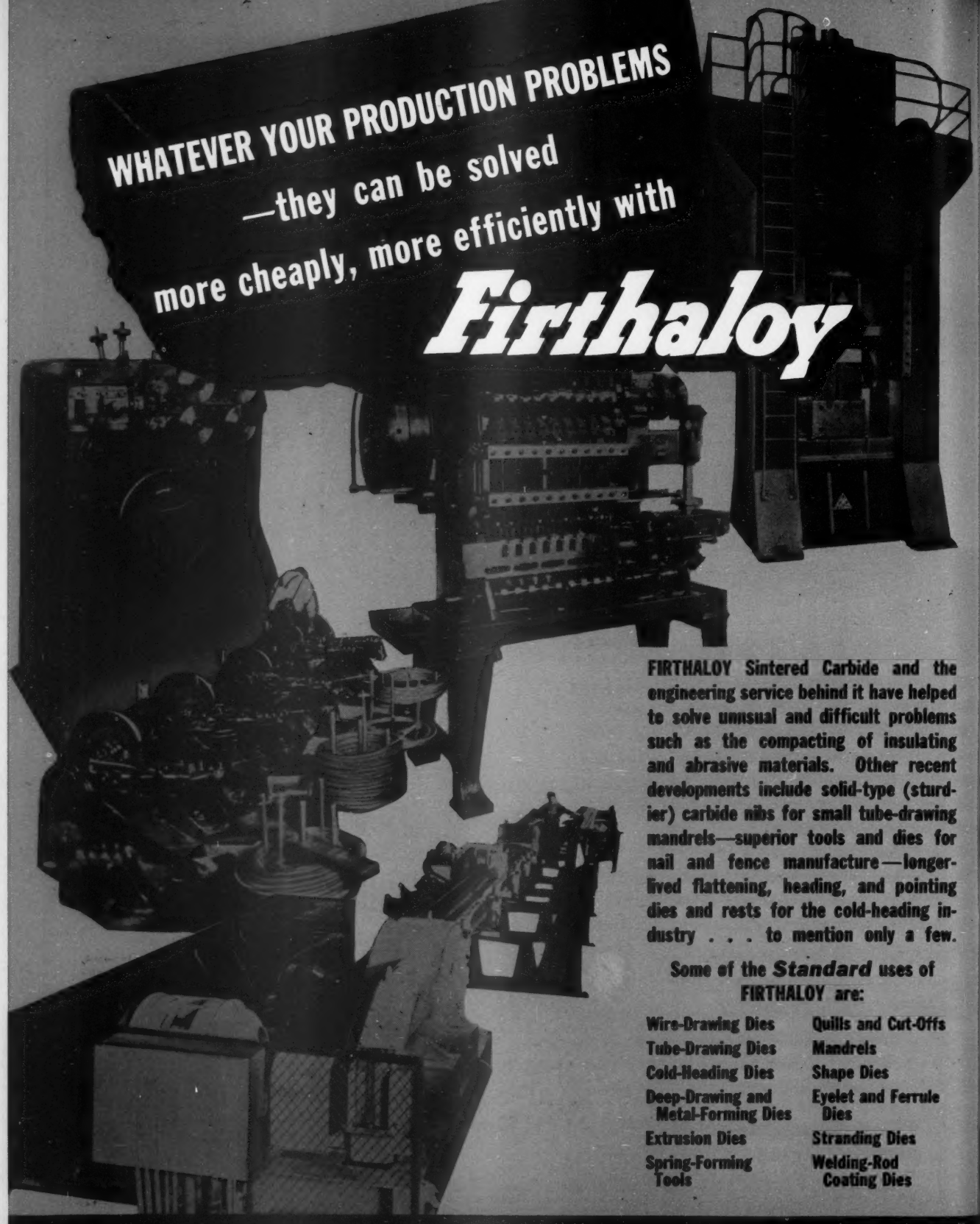

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A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 19 OCTOBER, 1944 No. 10

The Physical Properties of High Carbon Steel Rope Wire As Affected by Variations in Patenting

By H. J. Godfrey,
Development Engineer, John A. Roebling's Sons Company,
Trenton, N. J.

Introduction

DURING the discussion of **J. C. Aiken's** paper [1] at the Wire Association Meeting in Chicago last year, there were a number of questions pertaining to lead patenting temperatures and their effect on the properties of rope wire. The discussion of these questions was interesting but did not bring forth any specific information. Since we have been investigating this subject, the presentation of some of our findings may be of value. The work is rather narrow in scope as the range of size and analysis is limited and the extrapolation of these results to other conditions should be done with considerable care. However, we feel that the results illustrate the nature and deviation of the physical properties of cold drawn wire due to variations in the heat treatment of the patented wire.

Materials

THREE steels were used for these experiments and the chemical compositions of each are presented in Table I on the page following.

HOWARD J. GODFREY

Born April 24, 1909, in Needham, Mass. Attended schools in Needham and graduated from Tufts College in 1931 with a B.S. in Civil Engineering. Held Research Fellowship at Lehigh University from 1931-33 and graduated with M.S. in Civil Engineering. From 1934-1937 was Research Engineer with John A. Roebling's Sons Co. From 1937-1941 was Engineer of Tests at the Fritz Engineering Laboratory at Lehigh University. In 1941 became Develoomeent Engineer with John A. Roebling's Sons Co.

✦ ✦ ✦

THE steels were hot rolled to .187" diameter, patented and drawn to the following sizes for final patenting:

✦ ✦ ✦

	Patented Wire Size
Steel A	.083"
Steel B	.083"
Steel C	.096"

✦ ✦ ✦

Heat Treatment

AN 18 foot gas fired tube furnace with a 6 foot lead bath was used for the patenting process. Every precaution was taken to control the temperatures at each stage of the heat treatment. The furnace and lead temperatures were recorded continuously and were checked with an optical pyrometer and additional thermocou-

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TABLE I

Chemical Composition of Steels

	Carbon	Manganese	Silicon	Phosphorus	Sulfur	Copper	Nickel
Steel A	.75	.60	.189	.032	.031	. .	. . .
Steel B	.77	.64	.209	.035	.034	.059	.017
Steel C	.80	.50	.192	.016	.015	.119	.320

ples. The actual wire temperature at the exit end of the furnace was also measured with an optical pyrometer. Except for the time taken for this observation, the wire between the furnace and the lead pan was covered with charcoal.

✦ ✦ ✦

FOR the entire group of experiments the furnace temperature was maintained at 1650 degrees Fahr. and lead temperatures of 900, 1000 and 1100 degrees Fahr. were investigated. In the heat treatment of Steel C, the wire was air patented in addition to lead patenting. The actual wire temperature at the exit end of the furnace was approximately 100 degrees Fahr. less than the furnace temperature.

✦ ✦ ✦

PHOTOMICROGRAPHS at 1200x of the .80 per cent carbon steel are presented in Figure 1 and illustrate the effect of the lead temperature on the pearlitic structure. The air patented structure was coarser than any of the structures obtained by lead patenting.

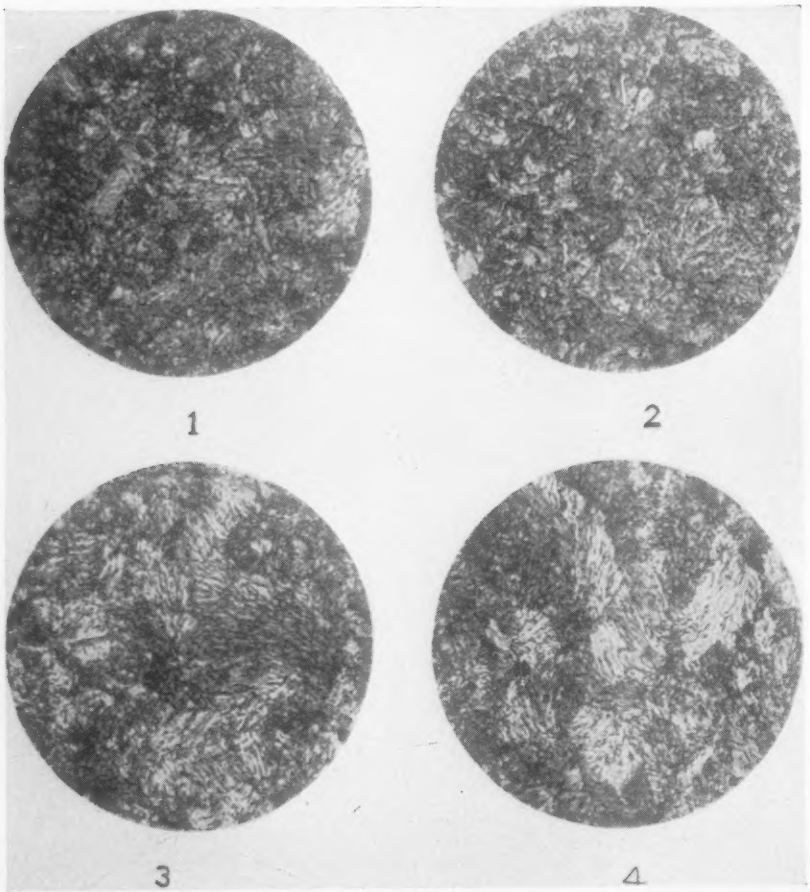

Fig. 1. Photomicrographs of .80 per cent Carbon Steel—1200X. ✦ ✦ ✦
1. Lead Temperature 900°F.
2. Lead Temperature 1000°F.
3. Lead Temperature 1100°F.
4. Air Patented

Wire Drawing

THE patented wire was cleaned in acid, limed and baked, and then drawn on single blocks using water cooled carbide dies. For each of the steels and for each patenting procedure, the wire was drawn until a tensile strength of 300,000 p.s.i. was obtained. The drafts used are presented in Table II.

TABLE II

Drafts for Wire Drawing

	Reduction per Hole (%)		
	Steel A	Steel B	Steel C
1st Hole	22	22.0	21.5
2nd Hole	25.5	24.5	27.0
3rd Hole	27.0	27.5	26.5
4th Hole	27.5	28.0	24.0
5th Hole	25.0	20.5	25.0
6th Hole	23.0	23.5	23.0
7th Hole	21.0	18.0	24.5
8th Hole	18.0	20.0	14.5
9th Hole	15.0		17.0
10th Hole			13.5

THE drafts shown in Table II were computed from the actual wire sizes. In some cases only 6 holes were necessary to obtain a tensile strength of 300,000 p.s.i., whereas the lowest patented strength required 10 holes. Samples for physical tests were taken at the back end of the coil at each hole of wire drawing.

✦ ✦ ✦

Physical Properties

THE tensile properties of the patented wire are presented in Figure 2 for each steel and for each heat treatment. The gage length used in these tests was 10 inches and the average of three tests is presented. The tensile strengths were approximately the same for the 900 and 1000 degree Fahr. heat treatments and then decreased considerably at 1100 degrees Fahr. The air patented wire had a lower tensile strength than any of the lead patented materials. The reduction of area was considerably higher for the 900 degrees Fahr. patenting temperature than for any of the other heat treatments. The recovered elongation values are approximately the same for each steel and each heat treatment.

THE effect of wire drawing on the tensile strength is shown in Figure 3. In this graph the tensile strength is plotted against the so-called "true strain" which is computed from the following equation: (For Fig. 3—See next page)

$$\text{True Strain} = \text{Log}_e \frac{A_o}{A_f}$$

When A_o = Area of Patented Wire
A_f = Area of drawn wire at any stage of wire drawing.

✦ ✦ ✦

WHEN plotted on this basis we find that the tensile strength is proportional to the true strain with the exception of the first and last parts of the curves.

✦ ✦ ✦

THE expression for true strain is derived from the following equation which was first suggested by **Ludwik** [2].

$$\text{True Strain} = \int_{L_o}^{L} \frac{dL}{L} = \text{Log}_e \frac{L_f}{L_o}$$

Where L_o = original length
L_f = final length or length at any stage of wire drawing.

✦ ✦ ✦

THIS definition of strain refers the change in length to the length from which the change was produced and would be entirely satisfactory for wire drawing since the elongation is uniform. We can assume that the volume of metal remains the same, ($A_f L_f = A_o L_o$), and thus express the true strain as follows:

$$\text{True Strain} = \text{Log}_e \frac{L_f}{L_o} = \text{Log}_e \frac{A_o}{A_f}$$

✦ ✦ ✦

THE latter expression was adopted since it is also applicable for conditions of plastic deformation where the strain is not uniform as in the case of the "necking down" period in the tension test.

THE above method of evaluating the amount of strain produced by wire drawing has been used by **Anton Pomp** [3] in his investigations on steel wire. **C. W. MacGregor** [4] has also suggested the same formula as a measure of the strain in the tension test and demonstrates that the true stress-strain curve becomes a straight line from the value corresponding to the maximum load to the actual breaking load. This means that the amount of strain hardening which takes place during the "necking down" period in the tension test is proportional to the maximum true strain.

✦ ✦ ✦

IF we assume that the slope of the linear section of the curves in Fig. 3 is a measure of the rate of strain hardening, we find, in Table III, the following rates in pounds per square inch per unit true strain for each of the steels investigated.

TABLE III
Rates of Strain Hardening by Wire Drawing Heat Treatment

	Lead Temperature—degrees Fahr.			
	900	1000	1100	Air Patented
Steel A	60,000 psi	60,000 psi	54,000 psi	
Steel B	60,000 psi	60,000 psi	57,000 psi	
Steel C	52,000 psi	52,000 psi	54,000 psi	51,000 psi

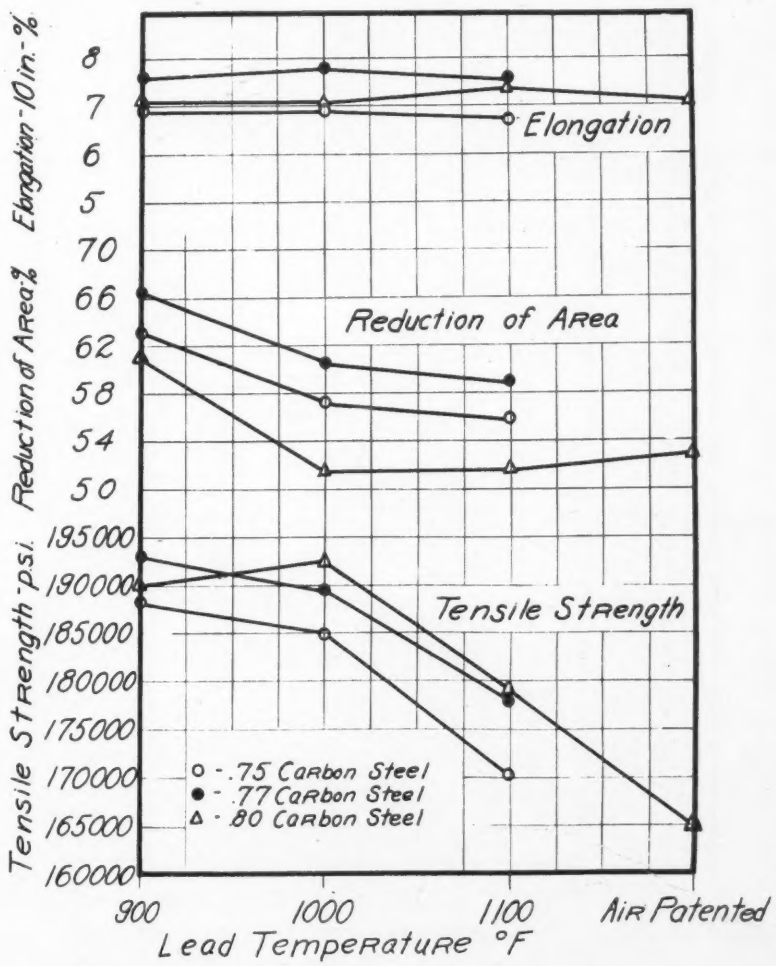

Fig. 2. Tensile Properties of Patented Wire. ✦ ✦ ✦ ✦ ✦

FOR each of the three steels the rate of strain hardening was lowest for the heat treatment which produced the lowest patented strength.

✦ ✦ ✦

THE more common method of evaluating the amount of wire drawing is with the following equation:

$$\text{Reduction of Area} = \frac{A_o - A_f}{A_o} - \%$$

✦ ✦ ✦

THE relation between the reduction of area and the true strain is presented in Figure 4 and demonstrates that when the total amount of wire drawing is large, a small change in the reduction of area is equivalent to a large change in the true strain. For example, an increase in the total reduction from 80 per cent to 85 per cent is a net increase of 6.25 per cent. When the same reduction is computed by the true strain there is a net increase of 18.5 per cent.

✦ ✦ ✦

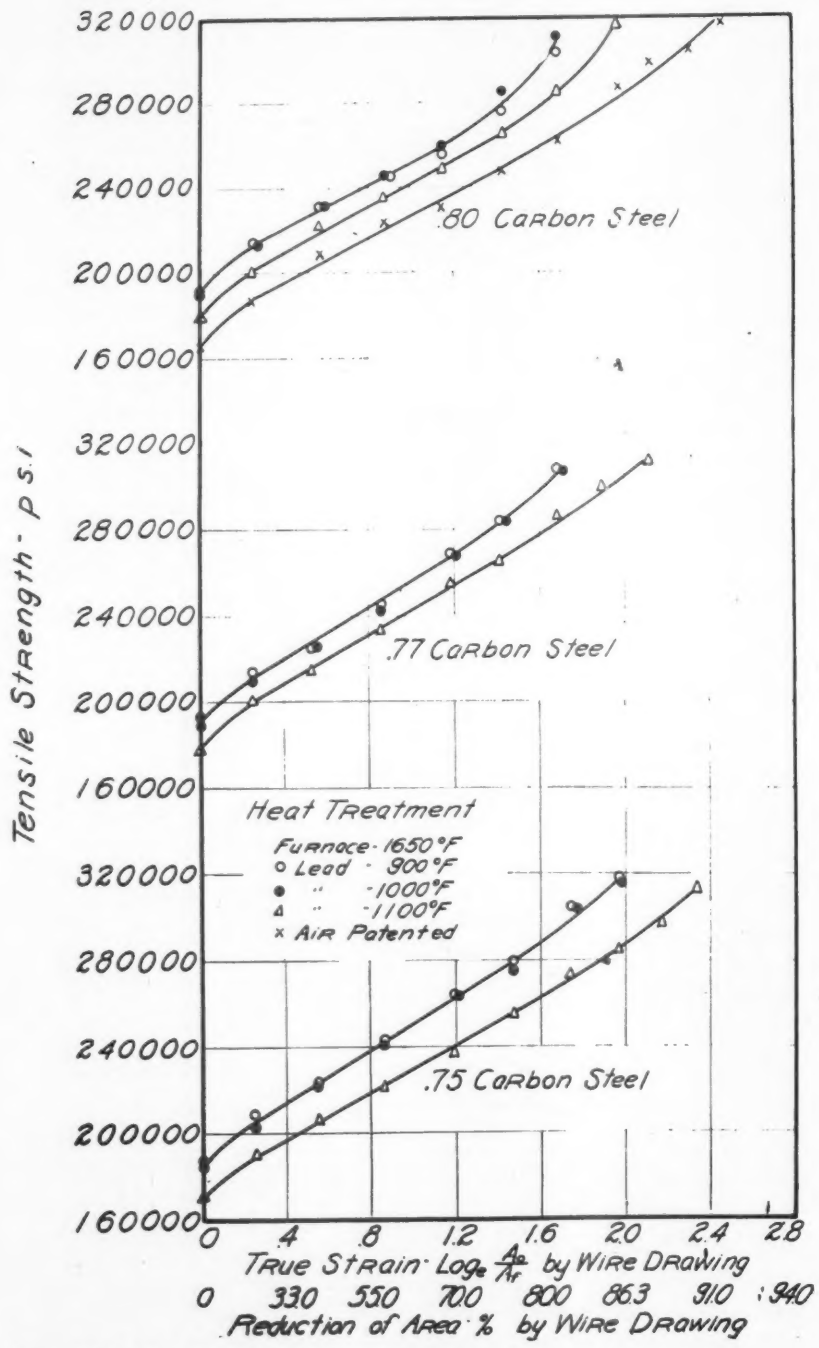

Fig. 3. Effect of Wire Drawing on the Tensile Strength of Steel Wire.

✦ ✦ ✦

THE results of the bend and torsion tests are presented in Figures 5, 6 and 7 along with the reduction of area and recovered elongation as determined in the tension test. The torsion tests were made on 8 inch specimens and the average values of either five or ten tests are plotted on the graphs. The reverse bend tests were made using mandrels having diameters ten times the wire diameters and the averages of at least five tests are plotted on the curves. The recovered elongation was measured between 10 inch gage marks and the reduction of area was measured by means of a shadowgraph at 50X. It is noted that the above physical properties are plotted against their corresponding tensile strength in order to compare the effect of the heat treatments on a common basis.

✦ ✦ ✦

IN general the torsions are quite irregular for the first two or three holes of wire drawing and then follow a definite trend. Considering the latter part of the curves for each steel, the material patented at 900 degrees Fahr. has definitely lower torsions than any other material. The material patented at 1100 degrees Fahr. has the best average torsions over the entire range of wire drawing. The torsions on the .80 per cent carbon wire drawn from an air patented wire were very uniform over the entire range of wire drawing. At a tensile strength of 300,000 p.s.i. the air patented .80 per cent carbon wire had slightly better torsions than the same material drawn from a lead patented structure.

THE results of the bend tests show that for each steel the 900 degree Fahr. lead quench produced considerably better bending properties than the other heat treatments. The bending properties decreased with an increase in the lead patenting temperature and were the lowest for the air patented wire. The number of bends increased with wire drawing up to approximately 75 per cent reduction and then decreased with further wire drawing.

✦ ✦ ✦

THE reduction of area curves are similar to the bend test results in that the highest reduction of area was always obtained with the 900 degree Fahr. lead temperature and the lowest reduction of area was obtained with the wire drawn from an air patented structure. With the exception of the wire drawn from the 900 degree Fahr. lead patented material, the shape of the reduction of area curves is very similar to the shape of the bend test curves.

✦ ✦ ✦

THE recovered elongation in 10 inches decreased very rapidly at the first hole of wire drawing. The elongation of the cold drawn wire was the same regardless of the heat treatment and gradually decreased with an increase in wire drawing.

✦ ✦ ✦

IN order to illustrate the general effect of the various heat treatments on the physical properties of rope wire we have averaged the results of all three steels at a tensile strength of 260,000 pounds per square inch. These values were taken from the curves in Figures 5, 6 and 7 and the average values are presented in Figure 8 for each heat treatment. The average curves show a direct correlation between the bending properties and the reduction of area. The torsions, however, are inversely proportional to the bends and reduction of area. The average torsions increased with an increase in the lead patenting temperature whereas the bends and reduction of area decreased.

Discussion of Results

THE tensile strengths of the tempered wire as affected by the heat treatment is due to the physical structure of the pearlite.

✦ ✦ ✦

GENSAMER [5] and his collaborators have found that the

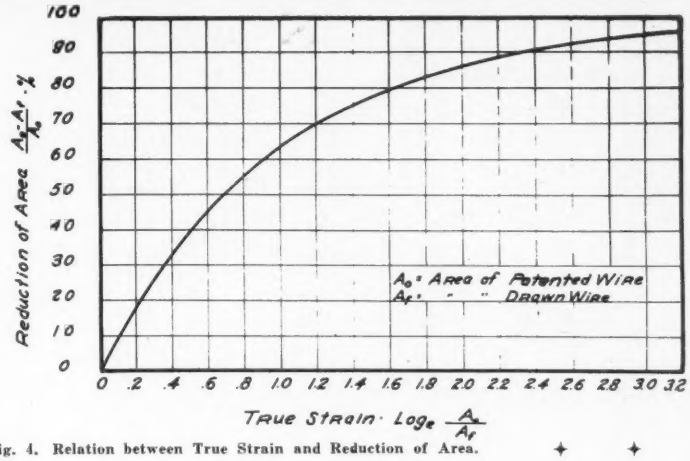

Fig. 4. Relation between True Strain and Reduction of Area.

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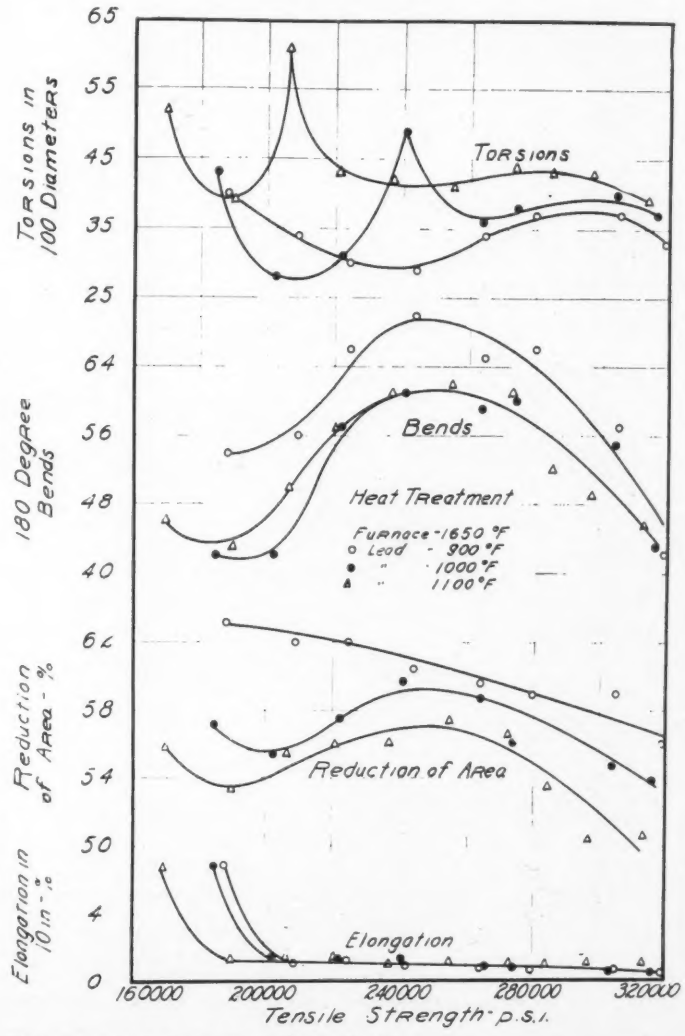

Fig. 5. Physical Properties of .75 per cent Carbon Steel.

✦ ✦ ✦ ✦

tensile strength varies linearly with the logarithm of the mean uninterrupted ferrite path in a pearlitic steel. It is interesting to note that for Steels A and B (.75 and .77 per cent carbon) the tensile strength with a 900 degree Fahr. lead bath was only slightly higher than with the 1000 degree Fahr. lead bath. The .80 per cent carbon steel actually had a lower strength with the 900 degree Fahr. lead quench than was obtained with the 1000 degree Fahr. lead quench. **Gensamer** [5] also found that the tensile strength of a plain carbon steel (.78 per cent carbon, .63 per cent manganese) increased with a decrease in the temperature of the reaction between temperatures of 700 and 550 degrees Centigrade (1292 and 1022 degrees Fahr.). At 550 and 500 degrees Centigrade (1022 and 932 degrees Fahr.) they found that the tensile strength was approximately the same and then increased with further decrease in temperature. The actual reaction temperatures were not determined in our experiments but the similarity in the test results is interesting.

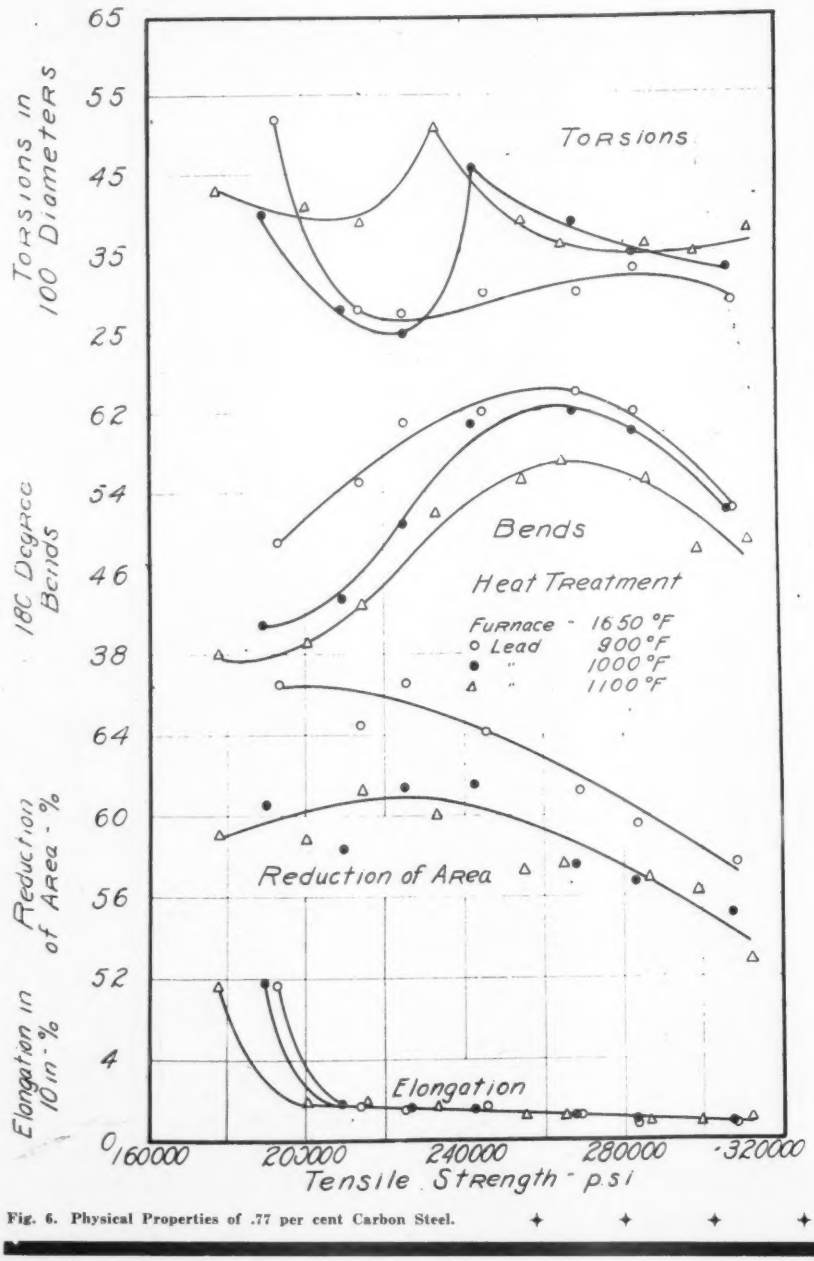

Fig. 6. Physical Properties of .77 per cent Carbon Steel.

✦ ✦ ✦

GENSAMER [5] also reported that the actual reaction temperature was affected by the size of material and was always above the temperature of the lead bath. For a lead bath temperature of 1020 degrees Fahr. the mean reaction temperature on a .25 inch diameter specimen was about 90 degrees Fahr. above the lead bath temperature and for a .125 inch diameter specimen was about 36 degrees Fahr. above the temperature of the lead bath. For a .075 inch diameter specimen the reaction began at 14 degrees Fahr. above the bath temperature. The above experiments were made with a plain carbon steel (.78 per cent carbon, .63 per cent manganese) and illustrate why the results of the effect of lead patenting should be limited in their applications to other sizes of patented wire. The diameters of the patented wires used for our experiments were .083 and .096 inches.

✦ ✦ ✦

THE tensile strength of the cold drawn .75 per cent carbon and .77 per cent carbon steels increased at approximately the same rate. The lower rate of strain hardening of the .80 per cent carbon steel is probably due to the lower manganese content in the steel. If the "true stress" (tensile strength based on actual area at the maximum load) at the maixmum load had been computed, the results would have been more linear, particularly between the patented wire and the first hole of wire drawing. Previous experiments [6] have shown that the uniform elongation is relatively large in a patented wire as compared to a cold drawn wire, and for this reason the net area at the maximum load would be relatively smaller on the patented wire. The curves in Figure 3 also show a more rapid rate of strain hardening during the last few holes of wire drawing. This may also be due in part to the use of the usual tensile strength

instead of the true strength at the maximum load and in addition, the preferred orientation would tend to increase the tensile strength at a more rapid rate at this stage of drawing. The temperature of the wire during wire drawing as well as the speed of drawing may also influence the rate of strain hardening.

✦ ✦ ✦

IN comparing the rate of strain hardening by wire drawing with the rate of strain hardening as determined in the tension test by **Hollomon** [7] we find that there is a large divergence in the results. Hollomon reports that the rate of strain hardening for a .78 per cent carbon steel ranges between 87,000 and 120,000 p.s.i. per unit strain, depending upon the heat treatment. The values that we report in this paper, as found by wire drawing, are between 51,000 and 60,000 p.s.i. per unit strain. As a result of these large differences we have determined the rate of strain hardening by wire drawing and also by the tension test on the following material and the results are presented in Table IV.

Material: .348" Diam. Lead Patented Rod, .80 per cent Carbon, .67 per cent Manganese Lead Patented, Nominal Tensile Strength 167,500 p.s.i.

✦ ✦ ✦

AFTER applying the correction factor as suggested by **Bridgman** [8] the rates of strain hardening are in fair agreement. The correction factor is necessary due to the non-uniform stress distribution over the neck of the tension specimen. The exact distribution of stress over the cross section of the neck is a very controversial subject at this time. The results of the few tests that we have made seem to substantiate **Bridgman's** solution to this problem.

✦ ✦ ✦

THE best ductility of the cold drawn wire, as measured by the bend test and the reduction of area, was produced by tempering at 900 degrees Fahr. However, the torsion test showed that the 900 degrees Fahr. lead temperature produced the lowest number of torsions. In evaluating the various tests we must consider that cold drawn wire is by no means an isotropic material and it is only reasonable to expect that physical tests which stress the wire in different directions will be more or less conflicting. In the torsion tests the maximum elastic shearing stresses are parallel and at right angles to the length of the wire. In the tension test the max-

TABLE IV

Method	Rate of Strain Hardening p.s.i. per unit true strain
Wire Drawing based on nominal stress at maximum load	55,000
Tensile Test assuming uniform stress over cross section	111,000
Tensile Test applying correction factor suggested by Bridgman [8]	51,000

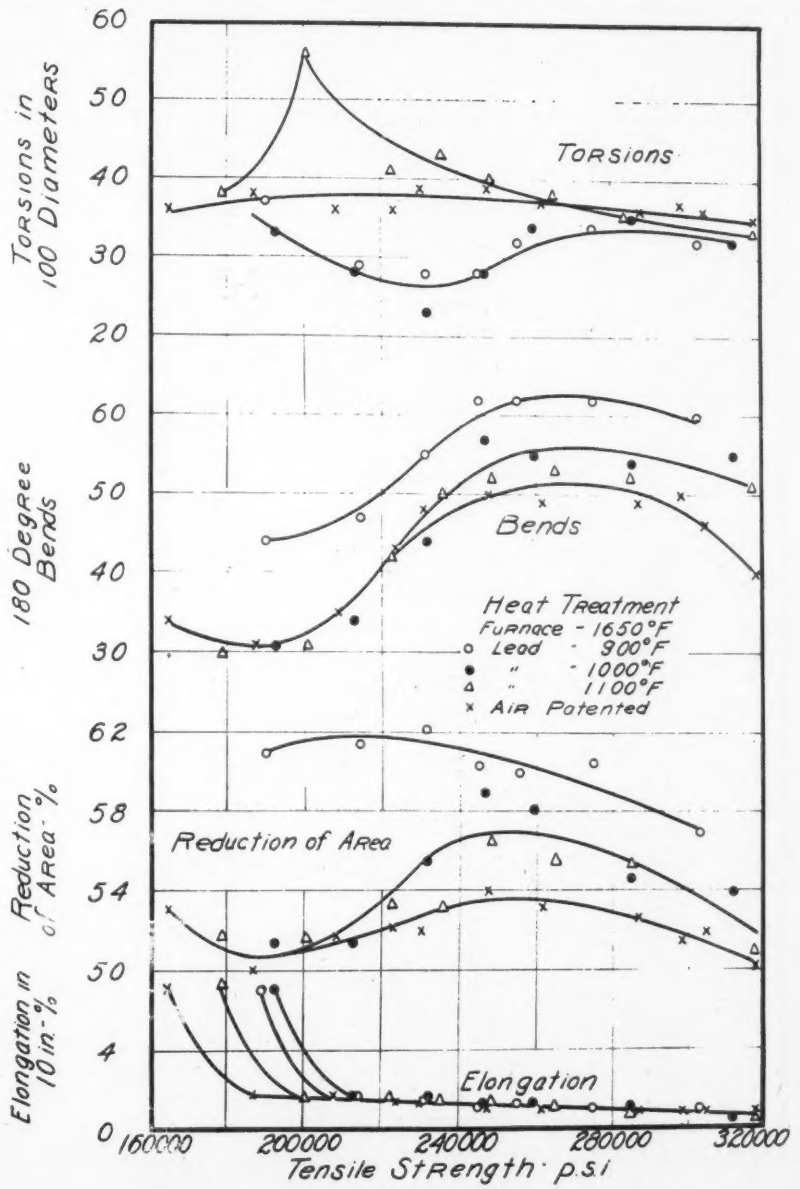

Fig. 7. Physical Properties of .80 per cent Carbon Steel. ✦ ✦ ✦

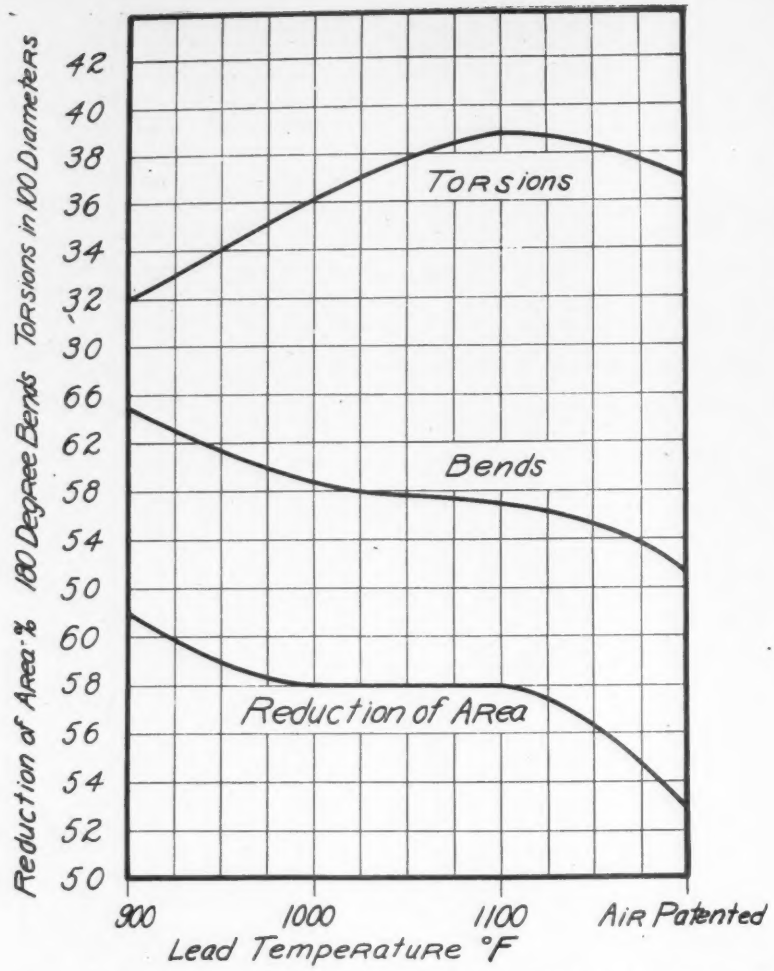

Fig. 8. Average Physical Properties of the .75, .77, and .80 per cent Carbon Steel Wire at a Tensile Strength of 260,000 p.s.i.

imum elastic shearing stresses occur on planes at 45 degrees to the length of the specimen. In the bend test the maximum elastic shearing stresses are at the neutral axis but the repetition of the reverse bending is similar to a fatigue test and the failure starts at the surface of the specimen and progresses at a rapid rate across the specimen. If there are any longitudinal planes of weakness, the bend test fracture will exhibit a long tongue-shaped fracture. In all of these tests we stress the material in the plastic range where the actual stress conditions may be very complex. It therefore becomes more of a matter of opinion and experience as to which property reflects the quality of service which might be expected from the wire.

THE results of the work covered in this paper demonstrates, however, that patenting has a definite effect on the physical properties of high carbon rope wire and the process may be controlled to give either high torsions or high reduction of area and bends. If all of these properties are required at a given tensile strength, a compromise in each of the ductility values will be necessary.

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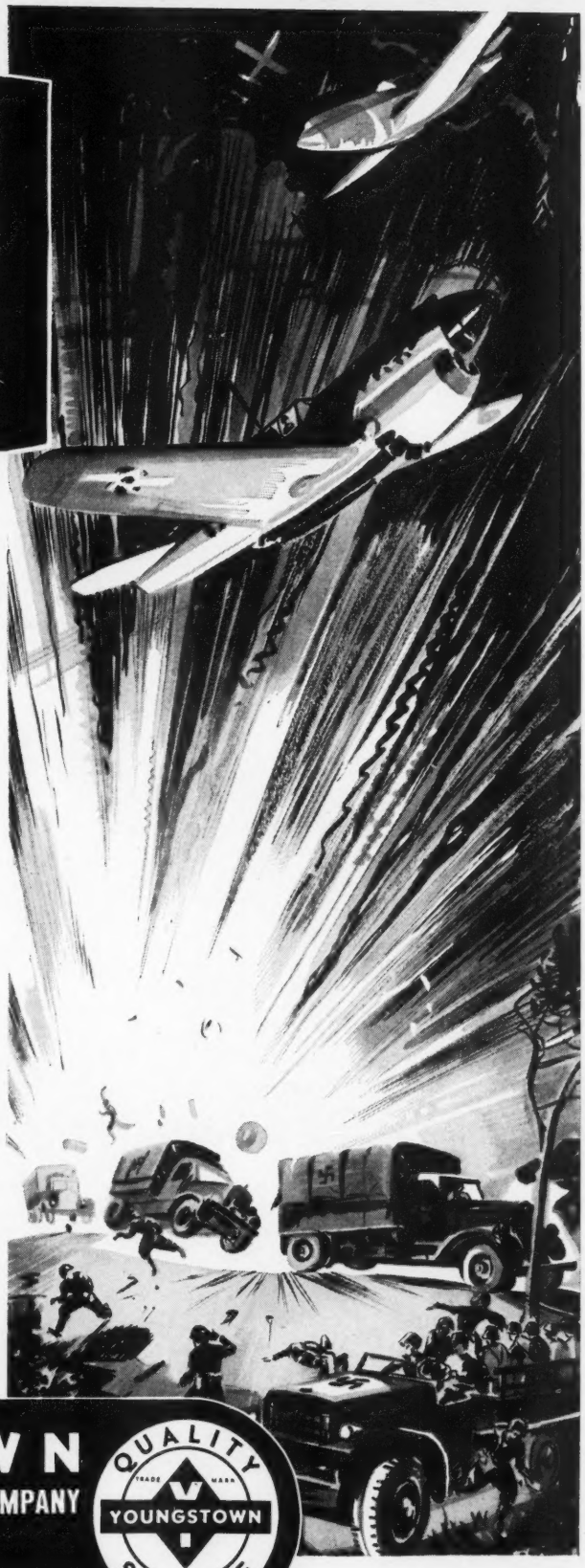

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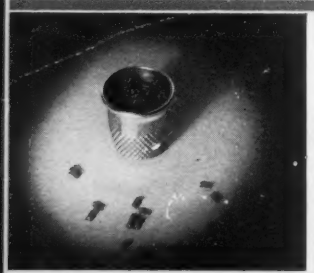

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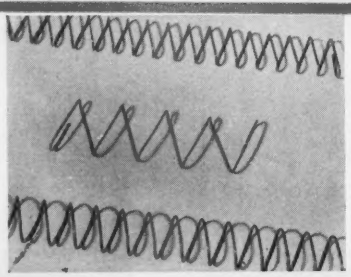

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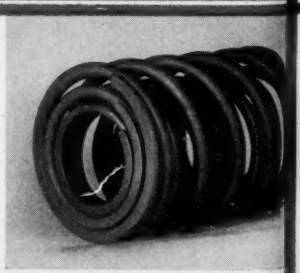

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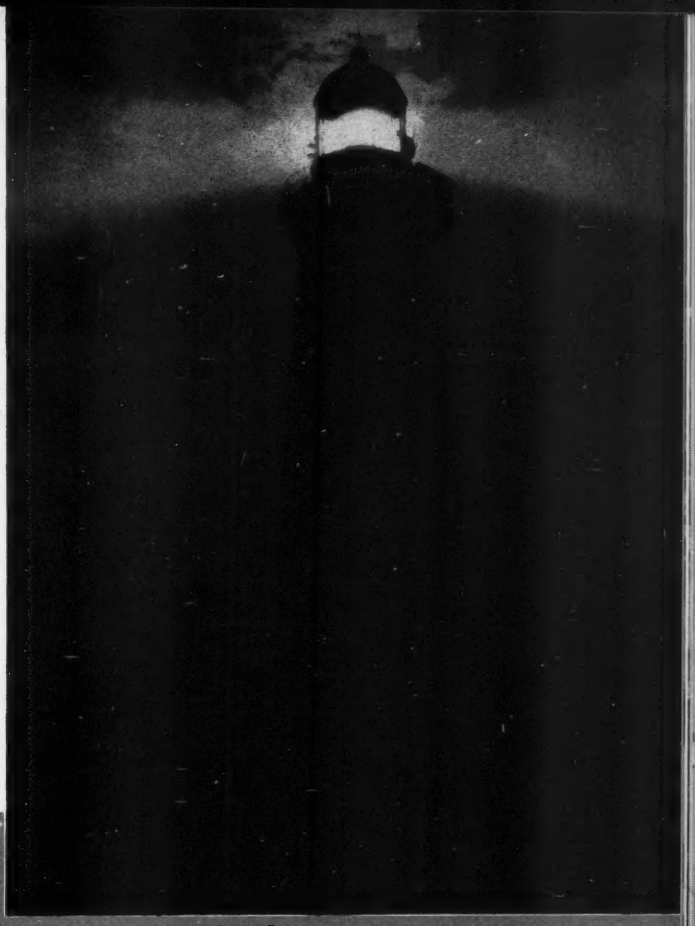

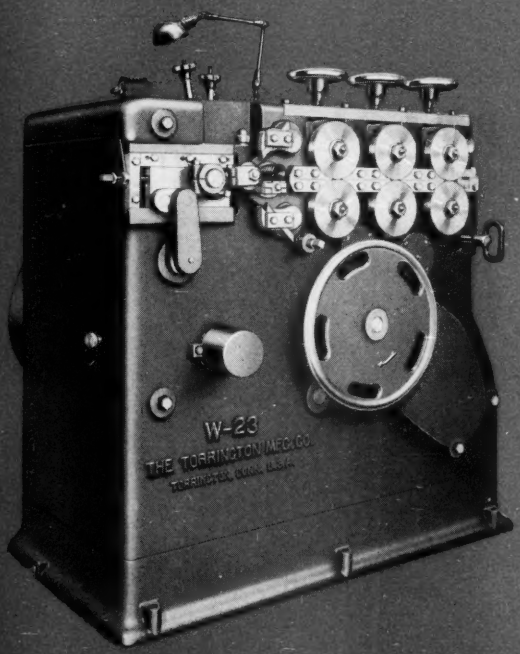

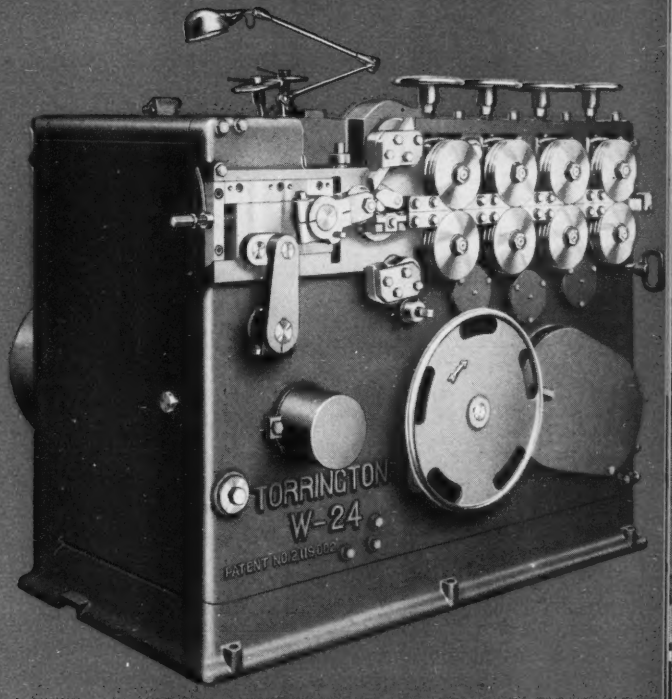

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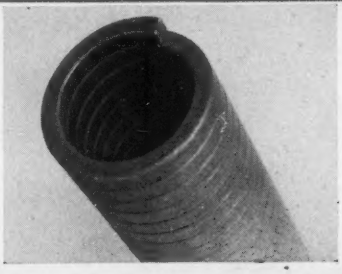

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The Meaker Company, Chicago, Ill.

A completely frank discussion of the shortcomings as well as the advantages of electrogalvanizing is developed on the basis of more than seven years' experience of installation and operation in a number of wire mills. The uniformity of the coatings, utilization of the zinc, and operating problems encountered are described. The superiority of electrogalvanizing destines it to much wider application in the future. ✦ ✦ ✦

IT is now some seven years since electrogalvanizing began to be applied extensively to wire. During this period a number of new plants have been installed, and the original installations have been improved and studied intensively. Descriptive literature hitherto has consisted largely of accounts of the advantages of electro-galvanizing written by electrogalvanizers from the viewpoint of comparatively limited experience in the wire field.[1] It is now possible to reassess the possibilities in electrogalvanizing in the light of the years of experience, bitter as well as sweet, that have accumulated.

✦ ✦ ✦

ALTHOUGH the writer has been active in the development of electrogalvanizing, the following account is intended to be frank and fair and not unduly biased by his interest. Electrogalvanizing must stand on its performance and not on the promises, however sincere, of its adherents. Information as to performance is generally available from some of the mills which are employing the process, and the following statements therefore can be readily verified. They are based on experience with the Meaker Process.

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WHILE some advantages originally claimed for electrogalvanizing are not quite as had been anticipated, other points have proved more favorable than expected. An honest appraisal will therefore be helpful. An open-minded consideration of electrogalvanizing can hardly fail to confirm its superiority to the old hot process.

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ELECTROGALVANIZED coatings have shown the full adhesion and ductility originally claimed, and have adapted themselves to new uses for wire. Corrosion tests continue to be promising, although one of the A. S. T. M. tests at first appeared to be unfavorable until the data were more carefully analyzed.[2] The high quality of electrogalvanizing has been increasingly recognized, as electrogalvanized wire became available.

ERNEST H. LYONS, JR.,
Chief Chemist, The Meaker Co.

Received the B.S. degree at Massachusetts Institute of Technology in 1931, and the M.S. degree at California Institute of Technology in 1933, specializing in electrochemistry and photochemistry. After a venture in gold mining, and brief experience in an analytical and consulting laboratory, he joined The Meaker Company, where he helped to develop the Meaker Process for electrogalvanizing wire. He is now Chief Chemist for The Meaker Company. He is a member of The Electrochemical Society and the author of a number of papers on electrogalvanizing and electroplating published by the Society; member of the American Electroplaters' Society and the American Chemical Society.

✦ ✦ ✦

Uniformity of Coatings

AS far as corrosion tests show, the superior life of electrogalvanized wire depends largely on its uniformity of coating thickness. If a zinc coating of 0.5 oz. per sq. ft. is distributed non-uniformly on wire, there will be some light spots and some heavy; some parts of the wire will have, say, only 0.3 oz./sq. ft. while others will have perhaps 0.7 oz. Wire with thin spots in the coating rusts first at these spots, although to some extent a small thin spot may be protected by a heavy deposit nearby. By and large, the wire is as good as its weakest spot, and all heavier regions carry an excess of zinc which is substantially useless.

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ON the other hand, wire on which the 0.5 oz. of zinc is uniformly distributed will have 0.5 oz. at every point. There are no weak spots at which premature rusting will occur. Every ounce of zinc applied acts to provide the full protection for which it is intended.

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THE uniformity of electrogalvanized coatings on wire is much more perfect than present tests can detect. Samples taken every hundred feet along a mile of electrogalvanized wire showed a variation in coating thickness, as determined by the strip test, of

[1] **E. H. Lyons, Jr., Wire and Wire Products 11, 655 (1936); Iron Age 138, 47 (1936); J. Am. Zinc Inst. 19, 50 (1938); Trans. Electrochem. Soc. 78, 317 (1940); C. C. Crane, Metal Cleaning & Finishing 9, 389 (1937); etc.**

[2] **Committee A-5, Proc. Am. Soc. Testing Materials 41, 1, (1941); E. H. Lyons, Jr., Trans. Electrochem. Soc., 80, 401 (1941).**

less than 1%. Specimens cut along the diameter, or across it, polished, and examined under the microscope, do not show measurable variations in thickness.

✦ ✦ ✦

IN one sense, however, the uniformity of the electrogalvanizing process falls short of perfection. This is in the variation from strand to strand across the galvanizing tank. If the wires are all held at the same distance from the anodes, and with uniform spacing between them, and the electrical contacts to the wires and anodes are all good, then there will be no variation in coating from strand to strand. This condition is not always obtained in practice. The cast zinc anodes are not perfectly uniform in height, and some of them dissolve slightly faster than others, so that the anode surface is not entirely uniform. Some strands of wire tend to "ride" higher than others, and contacts are not always perfect. Such variations largely average out as the wire proceeds through the galvanizing tank, but small differences in coating weight may persist.

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OPERATORS quickly learn how to place the anodes so that these variations are held to a minimum. It is not unusual for the strand-to-strand variation to be less than 2% across the machine. It ought not to exceed 4% under all operating conditions, and only with the most careless or unusual manipulation has it risen as high as 10%.

✦ ✦ ✦

IT need hardly be pointed out that such uniformity is rare indeed in hot dip galvanizing.

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A QUESTION which is often asked in regard to uniformity is: "How is a uniform coating obtained when all the anodes are below the wire? Why is not the coating heavy on the side of the wire exposed to the anodes and light on the opposite side?" The answer is one that any experienced wire man can give: Wire naturally and inevitably twists as it passes through the machine. It is completely rotated every few feet, and therefore the coating becomes uniform on all sides.

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EVEN without this unavoidable rotation, however, the uniformity would still be fair. Under the geometry and plating conditions employed, theoretical calculations indicate that the coating would be only 10% lighter away from the anodes.[3] This has been confirmed by laboratory experiment.

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THE rigorous uniformity of electrogalvanized coatings on wire is accordingly considered responsible for their superior life in atmospheric corrosion tests. The question of whether the pure zinc electrodeposit is less readily corroded than a deposit from a hot zinc bath, which is always contaminated with iron, is still undecided. In some instances, the impure hot dip zinc has been attacked much more rapidly; in others, less difference has been observed, but a small advantage has usually rested with the electrozinc. Whatever superiority may exist in this respect depends in part on the particular atmosphere and conditions of exposure. The high uniformity of electrogalvanizing doubtless far outweighs the factor of purity.

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Utilization of Zinc

FULL utilization of zinc demands the uniformity obtained by electrogalvanizing, for in this way no metal is wasted by applying a heavy average coating so as to guard against thin spots. This is of marked advantage during the current zinc shortage.

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AN even larger saving of zinc results from the absence of dross losses of zinc such as occur in hot galvanizing kettles. However, as no industrial process is actually 100% efficient, there are a few small losses of zinc in electrogalvanizing. A certain amount of the zinc electrolyte is carried out on the wire and rinsed off. In one large installation this dragout loss was determined to be about 4.6 gallons in 24 hours. This amount of solution contains about 3.1 lbs. of zinc, which was wasted down the sewer. During this period, 63 tons of wire were coated with 3700 lbs. of zinc. The dragout loss amounted to about 0.084% of the zinc consumed.

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ANOTHER source of loss is the metal plated on contacts and other portions of the machine, since some current leakage is not avoidable. It is not possible to calculate this loss, but it was estimated at less than 5 lbs. per day. Together the two losses did not exceed 0.21% of the zinc consumed.

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WHEN the anodes become very thin, they are piled on top of fresh anodes and are consumed. A few of the very thin remnants of anodes may slip off and fall to the bottom of the tank, where they are slowly dissolved by the acid in the electrolyte, so that this zinc is not lost but helps to replace the dragout losses from the bath. The utilization of the zinc is therefore well over 99%. The original claim that zinc is fully utilized in electrogalvanizing is thus well substantiated.

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Operation of Electrogalvanizing Lines

AN early claim which has not quite proved out, is a detail as to the ease of operation. It is true that the plant may be shut down in a few minutes, and will stand without attention, as claimed. The matter of starting it up again, however, is not quite as simple as might appear, although the line is placed in production merely by turning on the electric current and lowering the ducking rolls into the various baths. This is because the electrogalvanizing bath does not reach its steady operating condition and temperature for a few hours. Dur-

[3] **Private communication from Charles Kasper, National Bureau of Standards, Washington, D. C.**

ing this period, it may be necessary to operate at reduced speed, although with every factor favorable, it is often possible to reach normal operating conditions within an hour. On the other hand, if the shutdown period is less than 15-20 hours, no delay is experienced on starting up.

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IT was early believed that the application of very heavy coatings was simply a matter of choosing the proper speed and current to give the desired coating. This is true if all conditions are substantially perfect; then two or three ounce coatings are readily obtained by merely adjusting the controls. However, the electrodeposition of heavy coatings is somewhat more difficult practically than the deposition of coatings of 1 oz. or less. Difficulties will be encountered if galvanizing solution is not perfectly clean and in a well balanced condition. Sometimes it will be necessary to slow down somewhat until the solution is filtered and the pH adjusted for the best results. More often, heavy coatings are applied as easily as light coatings, by simply setting the controls properly.

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THE simplicity of operation is illustrated by the fact that a table of speeds and currents for various weights of coating on various sizes of wire is prepared for each plant. The operator sets the machine according to this chart, and the proper operation is automatically obtained. Operation is generally perfectly simple and flexible.

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IT is, of course, customary to operate at the maximum possible production. As the rate of zinc deposition depends on the current flowing in the galvanizing tank, the generators are set at their maximum capacity, and the speed of the wire is then chosen to give the desired coating. However, on light coatings it may not be possible to operate at the full speed which the generators will permit, either because the take-up frames will not run fast enough, or because the lead annealing is not quick enough, or for some other reason. Then the generators may be turned back to fit the highest permissible operating speed. The generators may also be turned back during warm-up periods, as has already been explained.

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AN annoying source of trouble encountered recently was contamination of the electrolyte from the rubber lining of the tank. During the war, many new rubbers have been used, and a few of them cause rough brittle coatings. This trouble is familiar to nickel platers, but only recently has it been observed in zinc plating. The source of the trouble appears to be the particular accelerator used to promote the vulcanization of certain rubbers. While most rubber is harmless, it should be tested in the electrolyte to make sure it will not damage the coating. Some contamination has also been traced to ordinary filter aids. On the other hand, while the electrolyte is sensitive to these contaminations, they have been experienced in only one installation; all the others have operated for several years without any trouble.

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MUCH has been learned, of course, about the handling and guiding of wire through the various tanks. The original contact fingers have been completely redesigned and improved. Rinses, guides, separators, electrolytic cleaners, and other steps of the process have been made much more effective.

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IT has sometimes been desired to run wires at various speeds at the same time, in order to deposit differing weights of coating. Although some progress has been made along this line, this is not yet generally feasible. Such operation demands sectional ducking rolls, which so far have not worked out well; but development in this direction is continuing.

THE great stress originally laid on the cleaning of the wire, has been re-emphasized rather than diminished by experience. The power of the cleaning methods has been improved and made more than adequate for the handling of all types of wire at all feasible speeds without excessive consumption of electric power or chemicals. The importance of the alkaline cleaner before the pickle to maintain best operation, has been verified. The source of contamination of the wire still appears to be the partial decomposition of the drawing compounds, as was stated seven years ago.[1]

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THE color of the coatings has generally been mildly lustrous and semi-bright. While not as brilliant as the "silver bright" hot galvanized wire or burnished electrogalvanized wire or burnished electrogalvanizing, after a few months of storage the semi-bright electrogalvanizing often appears brighter than the more highly finished coatings.

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Drawing Electrogalvanized Wire

ONE of the most interesting applications of electrogalvanizing has been in coating wire before it is drawn down to finer sizes. The electrogalvanized coating is not damaged in the least by this operation, but is reduced in direct proportion to the reduction of the wire. It is more economical to handle the wire through the galvanizing in large sizes, and draw it down afterwards, than to galvanize the long lengths of fine wire. Drawing after galvanizing also gives a harder stronger wire. The zinc is a good die lubricant and drawing at high speeds is possible, with very little wear on the die, when the proper technique has been learned.

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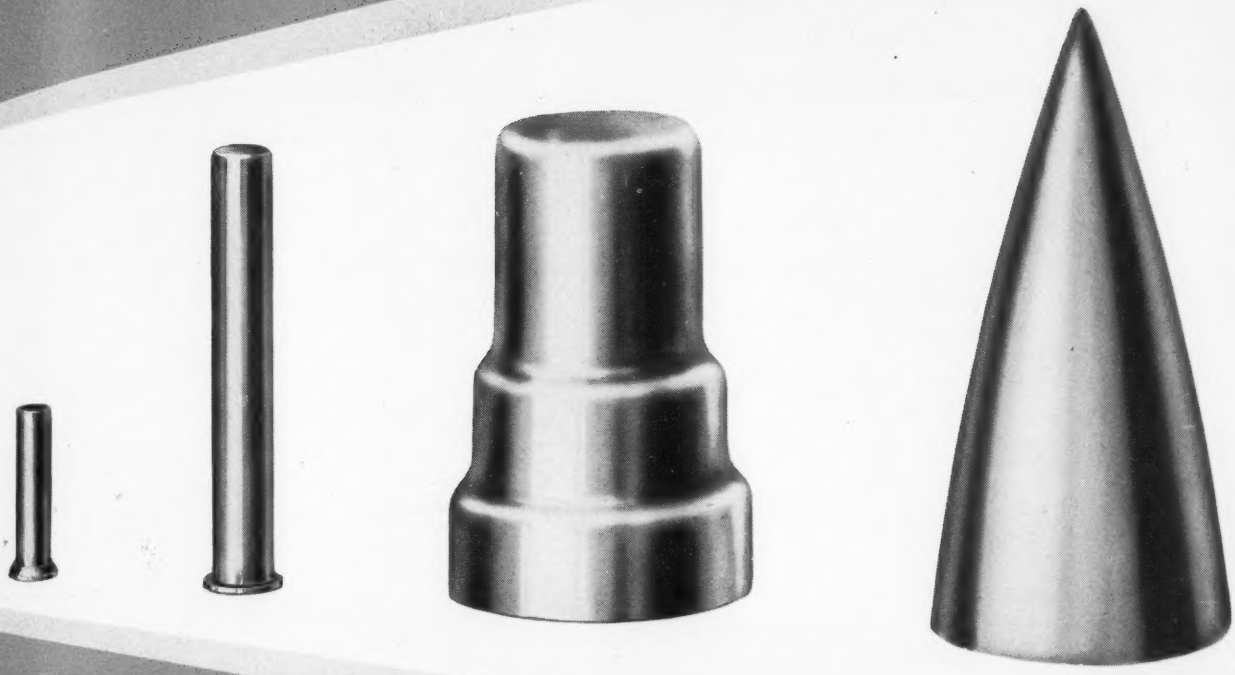
IT is often asked, "What makes electrogalvanizing stick so perfectly when there is no alloy to bond it to the steel?" If steel is properly cleaned, the zinc is laid

(Please turn to Page 732)

from small eyelets to
BIG DEEP-DRAWS



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Some Problems Influencing the Drawing of Fine Wire

By H. P. Edinga,
Wire Division Manager, North American Philips Company, Inc.,
Dobbs Ferry, N. Y.

SUMMARY

A list of products and applications is given. The paper further deals with difficulties encountered and discusses, e.g., machinery and labor. Considerable attention is given to the die problem, also in connection with cost price. ✦

TO our knowledge, there is no generally accepted line of demarcation between heavy, medium and fine wire. Therefore, what one person calls "fine", may be called "medium" by another. In order to avoid confusion, it is well to point out that the writer considers as fine wire, diameters below .002″ for all cold-drawn materials — this is about the size of a human hair. In the case of tungsten, which is hot-drawn, diameters smaller than .001″ are similarly classified.

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THE importance of fine wire in the world of today is best illustrated by the following list of applications:—

1. **Tungsten (.0004″ diameter and larger) is used in incandescent lamps and electronic tubes.**
2. **Molybdenum and its alloys are employed for radio grid laterals.**
3. **Gold and silver (size .002″) finds its way into braid and various types of insignia.**
4. **Copper (.0008″ and larger) goes into instruments.**
5. **Aluminum and aluminum-magnesium alloys (size .0012″) are needed for photoflash bulbs.**
6. **Nickel-chromium alloys (.0008″, .001″, .0013″, and .0015″) are used for electric resistances.**
7. **A number of other materials such as platinum and alloys, and recently also zirconium. Steel wire, .0015″ and larger, is used for recording purposes.**

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IN many cases the requirements for these wires are very rigid and call for close tolerances, perfect roundness, and faultless surface condition. An instance of this is when the wire is to be subjected to enamelling, cataphoresis and plating — as for example when molybdenum is to be gold plated for certain radio tubes — operations which all require a good base.

AS a rule, in talking about quantities of fine wire, we express ourselves in length, in feet, rather than in pounds, although there are exceptions. In this respect, it should be mentioned that "per pound" the price on some of these wires sometimes seems to approach astronomical figures whereas a unit price per thousand feet gives quite a different and more reasonable looking picture.

HARMEN P. EDINGA

Born June 25, 1897 in Heerenveen, (Fr.) Netherlands. Graduated in Mechanical Engineering from the M.T.S. (Technical College) in Leeuwarden, Netherlands. Was employed with the N. V. Philips Glowlamp and Radio Works at Eindhoven, Holland, in December, 1920, as assistant in the Wire Division, Tungsten and Molybdenum manufacturing department. Later in charge of manufacturing in cold drawing department and in 1932 also of the electrical oven department. Came to the United States for a special assignment in 1940 and went to work at Philips Metalix Corporation in Mount Vernon, N. Y. In 1942 was put in charge of fine wire drawing and diamond die departments of the North American Philips Company, Inc., at Dobbs Ferry, N. Y.

IN drawing fine wire, we meet more or less, the same problems as in drawing heavier sizes, but we would like to say that the difficulties involved are more accentuated. Very likely, for instance, the bad drawing quality of aluminum alloys is due to the fact that oxide particles are present. As long as the wire is heavy, this only shows up adversely on die wear, but in the case of small diameters, these particles form a comparatively large portion of the cross-section and not being ductile, will cause a rupture.

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BLOW holes will start giving trouble not in the heavy drawing stages, but later in the small sizes.

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WE should separate the wires into a hot drawn and cold drawn group.

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THE hot drawn types are few and the group consists chiefly of tungsten and, to a certain extent, molybdenum.

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THE second group contains all the ferrous and non-ferrous metals and alloys except the above mentioned.

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AS the first group, although very interesting, is confined to a small number of manufacturers, we will only bring these wires into discussion where there are typical differences.

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IN the cold drawn group, we will discuss the following:—

a. machines
b. labor
c. lubricants
d. dies

✦ ✦ ✦

(a) Machines

IN order to produce economically at reasonable prices it is desirable to use multiple drawing machines. An exception here is the drawing of tungsten which is done on single die drawing units. The generally used machine with straight rolls can be employed in most cases.

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HOWEVER, when drawing down to .001". experience has proven that this machine has some undesirable qualities. First of all, it is better to use a stepped drum in order to decrease slippage which in some cases is detrimental to surface quality. The arrangement of these rolls vertical, horizontal, or at an angle, is immaterial.

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IN most cases, the drums are either running in the lubricants or they are continuously sprayed with coolant, as shown in Fig. 1. Although this method has advantages, in certain cases we prefer dry drawing. This means a dry drum.

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THE very fine wire, instead of slipping over the wet drum, has a tendency to stick to it causing breakage. In case of dry drawing, with the lubricant applied in the die holder, the drums must be very hard, well polished, and well cleaned.

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IT will be understood that a thorough practical knowledge and long experience are necessary to successfully draw such wires. The "know-how" includes various small tricks which can only be picked up in practice. If a diamond does not fit tightly in the casing, lubricant may seep through and stick to the wire after it has passed through the die. This in turn, if only slightly, will moisten the drums, causing a break of the wire. Cleanliness during operation is of paramount importance.

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DRAWING speed may vary between wide ranges, 300 feet to 10,000 feet per minute, depending largely on hardness of the wire.

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(b) Labor

WE have tried men as well as women on the job. It has been proven that even though one would expect this to be a typical woman's job (requiring high finger dexterity) men often do better. On the other hand, for the very fine drawing of tungsten, for instance, .0005", women are preferred. However, some workers, both sexes, show a lack of adaptability to this particular kind of work.

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TRYING out a new worker is very expensive, as our records have shown that it is not possible to decide about basic ability before one month has passed. Four to six months can be considered normal to break in an operator for certain jobs, but much longer time is needed to produce a first class drawer. Besides dexterity, basic qualities seem to be the most important factors, (e.g., a calm, patient attitude). A psychotechnical test would be helpful and is recommended.

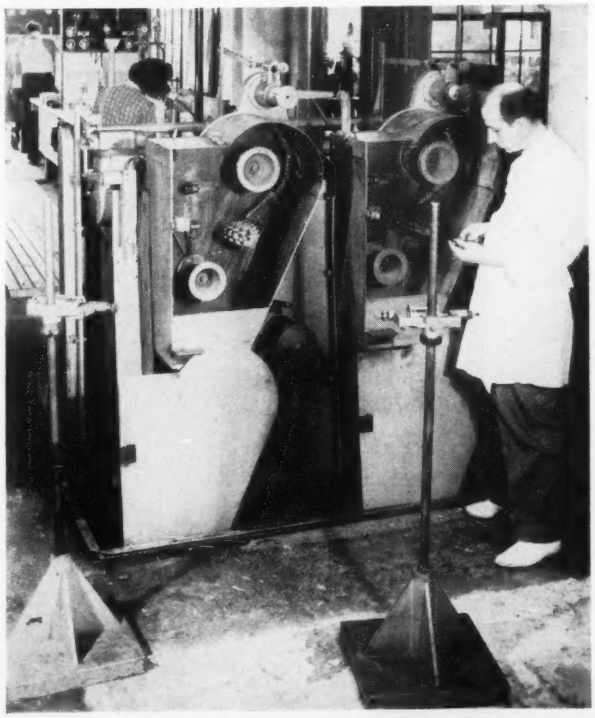

Fig. 1. Photo shows a multiple wire drawing machine. Mr. van denZeese Laar is shown at the machine.

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(c) Lubrication

THE wire industry is notorious for its being secretive, though considerably more information has been given out lately. Every wire drawer grown up in the hard school of practice has his pet opinions on the subject of lubrication. We also have done considerable experimenting with commercially available, as well as home-made lubricants, varying between rape seed oil, castor oil, soapwater, and mixtures, etc., in innumerable different proportions. At one time, even horse fat and beer were added. Aquadag and oildag (graphite suspended in water and in oil) are used for tungsten and molybdenum. In view of the delicacy of the subject, it seems to be expedient not to make any definite statements.

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LUBRICATION is one way of protecting the dies. Another way, particularly if the wire to be drawn is of the hard-wearing kind, is by covering the wire with some soft material. For instance, a stainless steel rod can be mounted in a copper sleeve and after the whole assembled rod is drawn down in wire, the copper tube can be dissolved.

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VERY often the small dimensions present too many difficulties in in the case of fine wires, not only in the applica-

tion of this protection but even more so in its removal As the majority of such wires have to be annealed these protecting layers **must** be removed. It is obvious that if they remained, alloying would occur and consequently the physical properties of the material would change, such as electrical resistance. Even small additions are harmful. Examples of this protection are lead for chrome nickel alloys, and silver for beryllium copper, recently mentioned by **Mr. F. S. Stickney** in his article in **Wire & Wire Products** of March 1944.

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SOME other possibilities with lesser known materials such as Indium, might have a future but need considerable experimenting.

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(d) Dies

AS we are only dealing here with small wires, we will only discuss diamond dies. Carbide dies have not been manufactured in these fine sizes. Very likely, moreover, there would not be appreciable advantage in using them in this special case.

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Government Encouraged and Helped Diamond Die Industry

BEFORE the war, everyone of these small dies was imported at very reasonable prices from France and Holland. Philips imported a considerable number of dies into this country. When this line of supply was cut off a serious shortage would have developed if it were not for the fact that an appreciable reserve was available mostly held by the large manufacturers.

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IN the meantime, American industry put itself to work guided in many ways by **government authorities.** It not only succeeded in producing the required quantities but even improved (mechanized) the process in such a way that partly the manufacturing has changed from being a skilled job to what we would like to call a job requiring experience.

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FOR those who would like to know more about this subject, we recommend reading of the book, **"Diamond & Gem Stone Industrial Production"** by **Paul Grodzinski** and several reports issued by the **Office of Production Research and Development of War Production Board.** Also, the article **"Fine Die Problems"** by **Paul L. Herz** published in the April 1941 issue of **Wire & Wire Products.** We also refer you to **"Gems and Gem Materials"** by **E. H. Kraus** and **C. B. Slawson.**

THE success of this fine wire drawing depends to a large extent upon the dies, and the poundage, or rather footage of wire per die plays a dominant role in determining the cost price, especially of the heavy wearing materials. Let us take as an example nickel chromium alloys. The manufacturers — under heavy pressure of the threatening die shortage — in the course of the last couple of years improved considerably on the footage of wire per die.

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Production Per Die

VERY little concrete information regarding the quantities of wire per die has been released. It seems, however, that the output per die varies greatly for the different wire producers. This may be due to quality, mainly the shape of the die, and also polishing, or to the more or less perfected method of drawing. Speed, lubricant, etc., are influencing factors.

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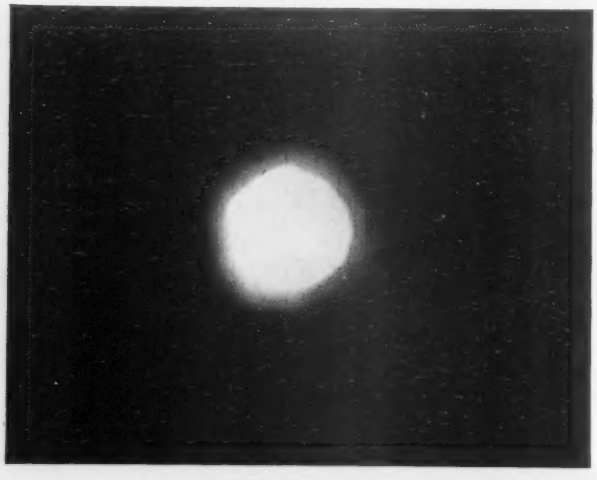
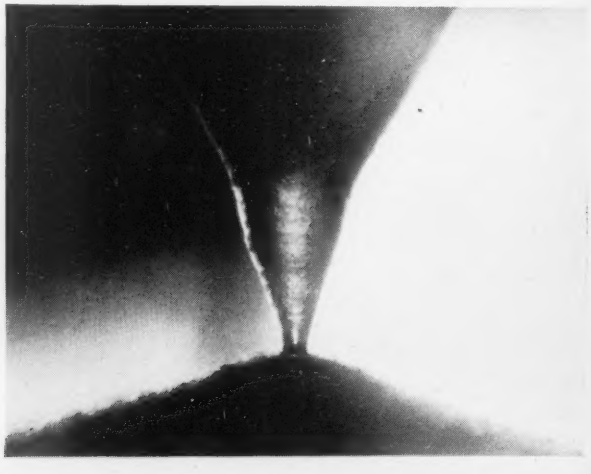
IT is known that whereas three years ago the output per die was about one to two pounds, recently averages of 5 pounds are possible and in individual cases, 20 pounds for a single die (in the size, .0013″/.0014″) has been reached. It is deplorable that no comparison is possible because no uniform method of indication is



(a) Cross-section.



(b) Lateral view through window.

Fig. 2. Photo shows a badly-shaped die. Wire drawn was a nickel chromium alloy.

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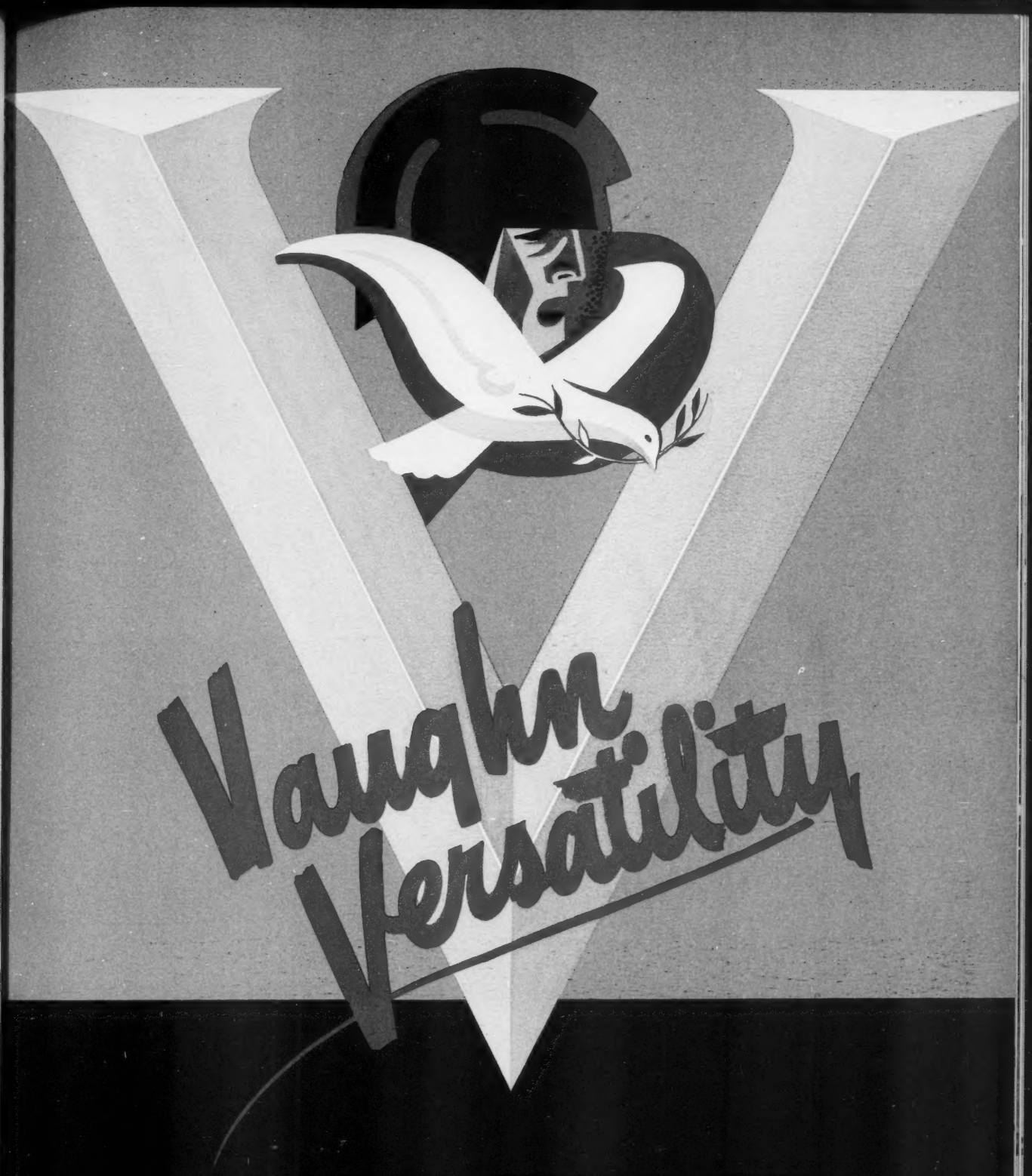

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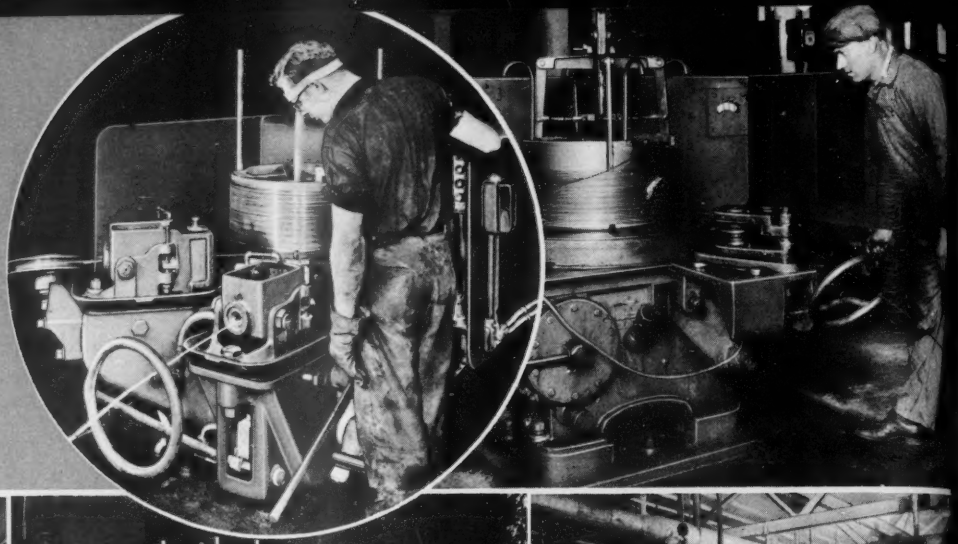

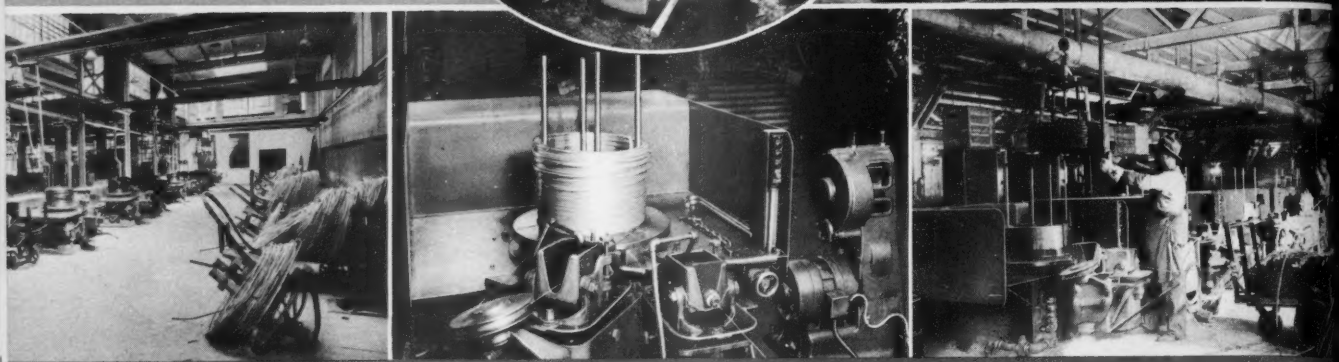

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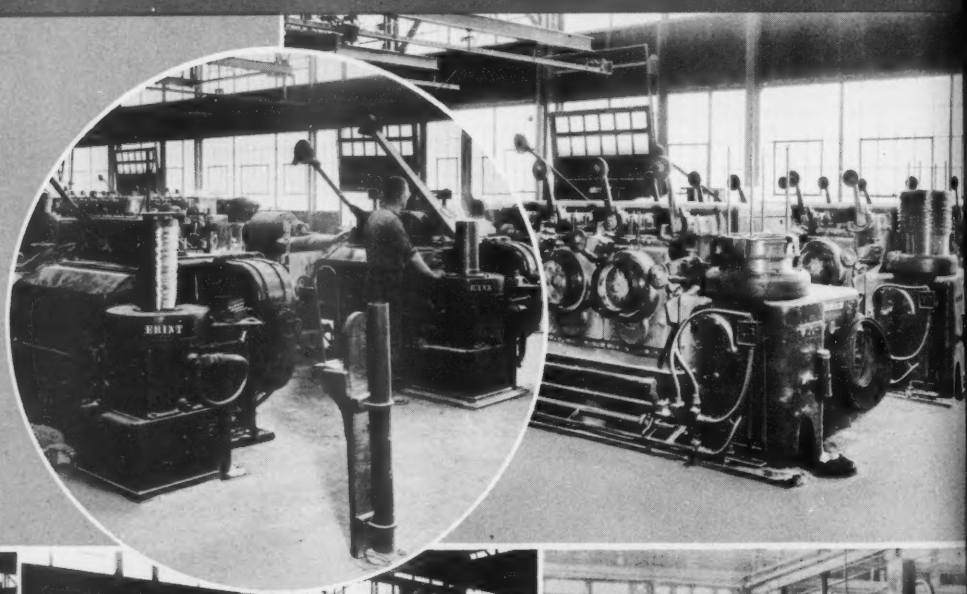

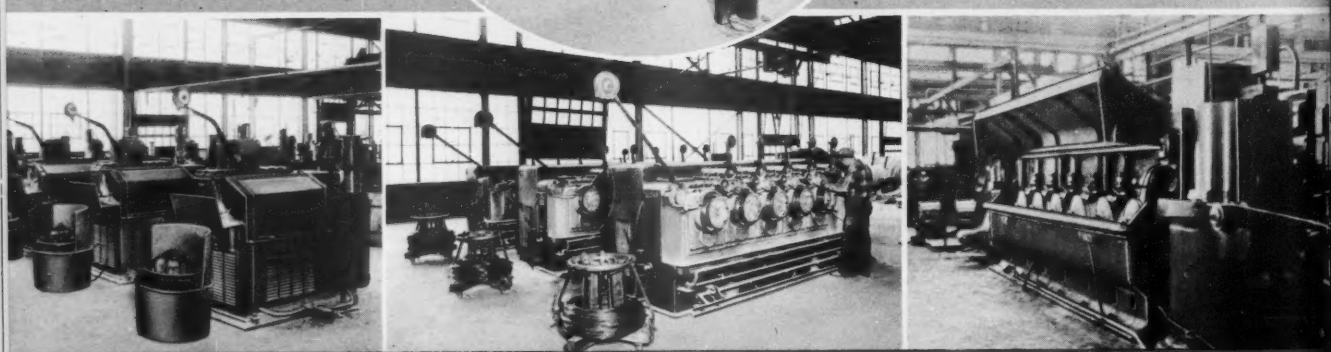

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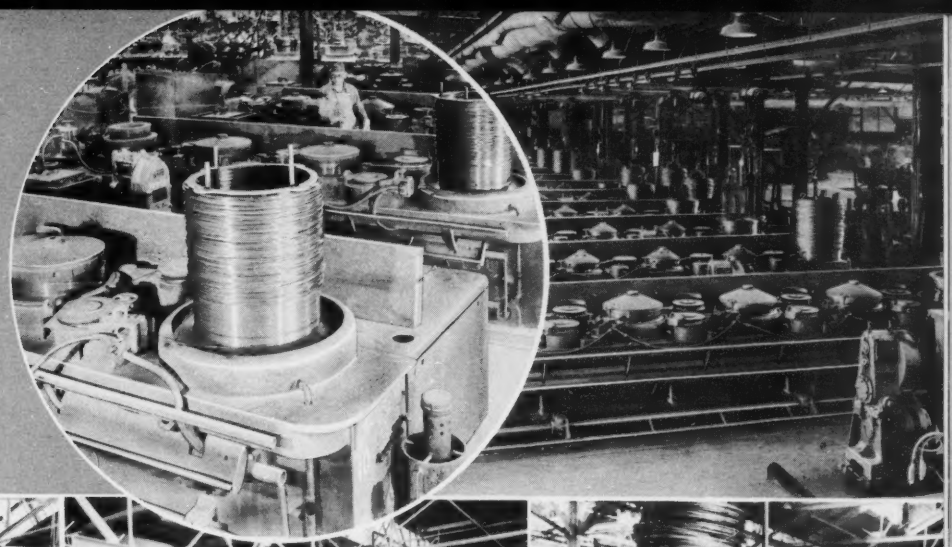

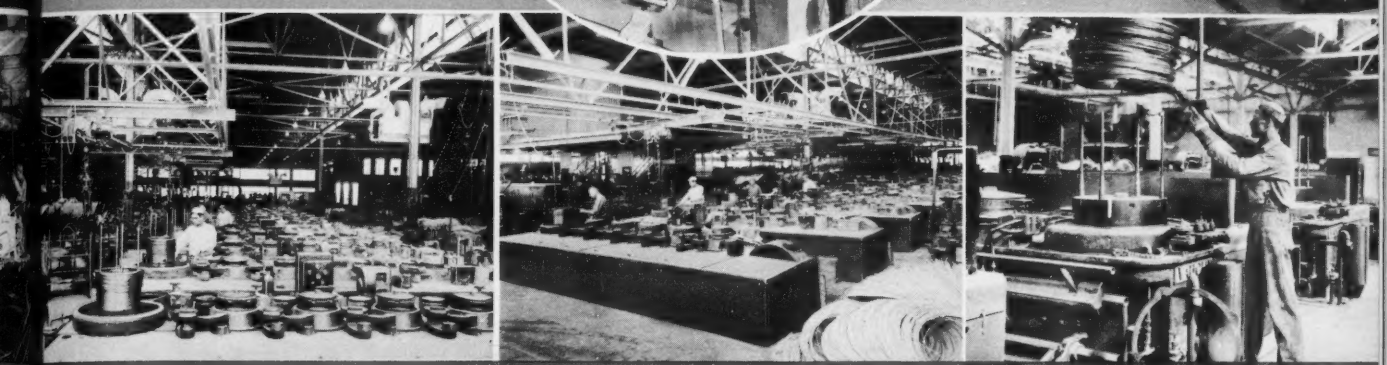

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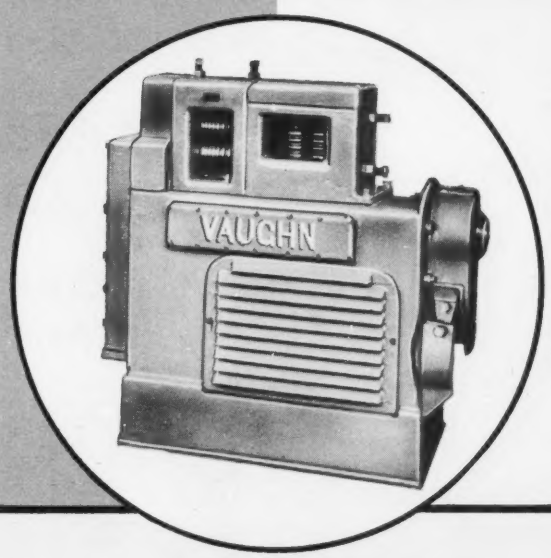

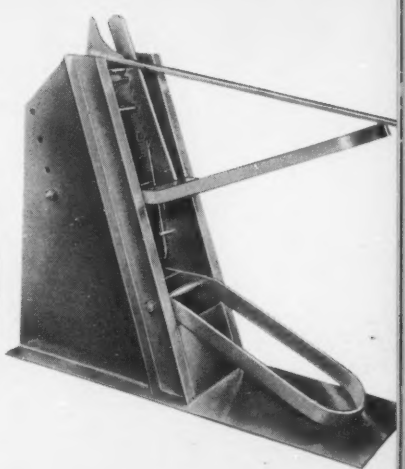

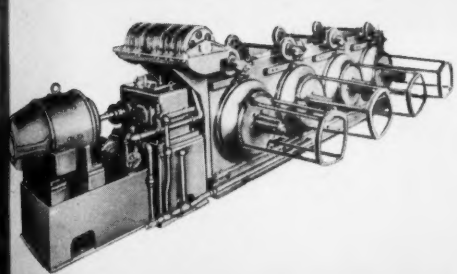

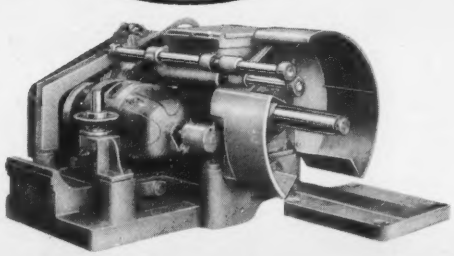

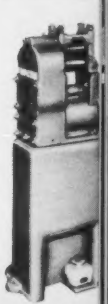

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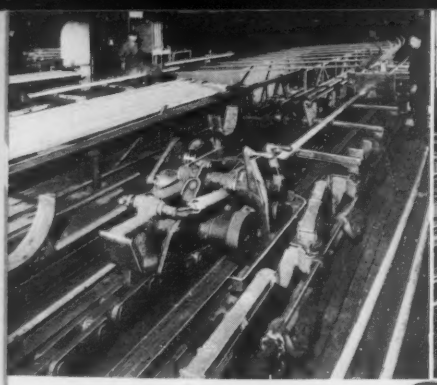

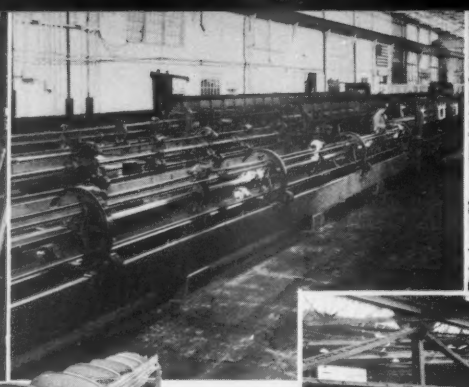

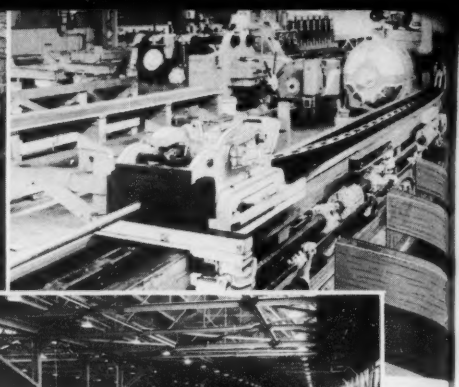

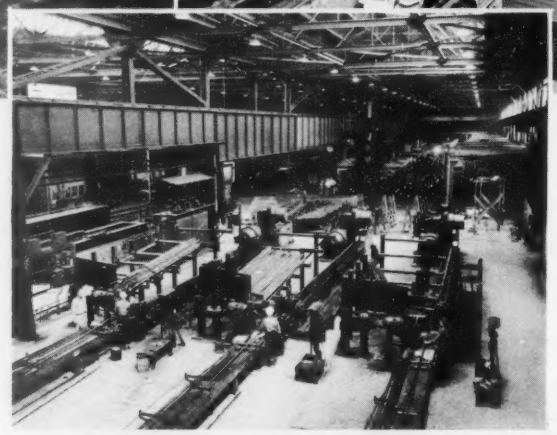

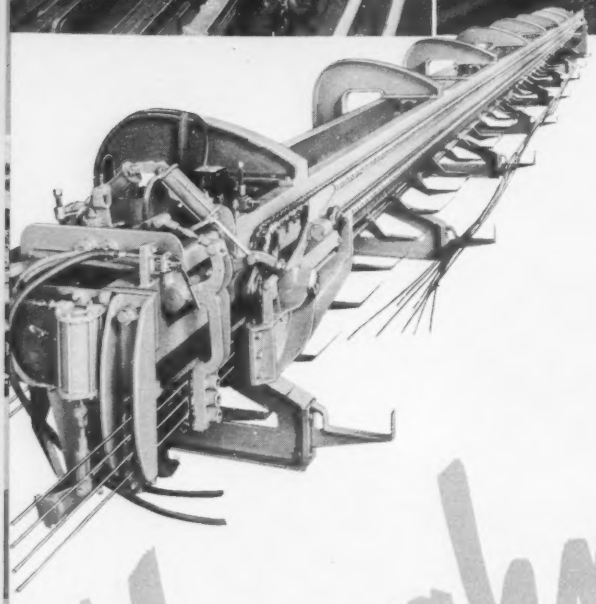

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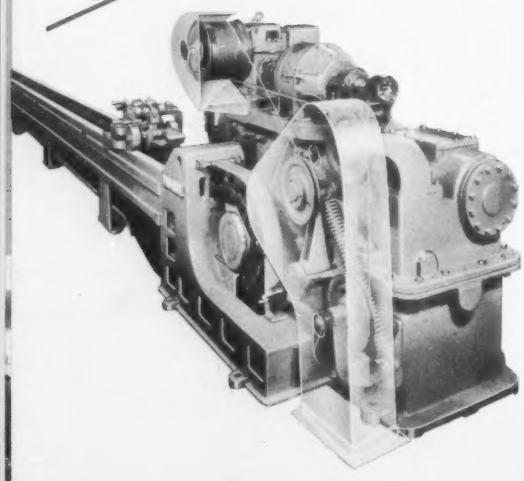

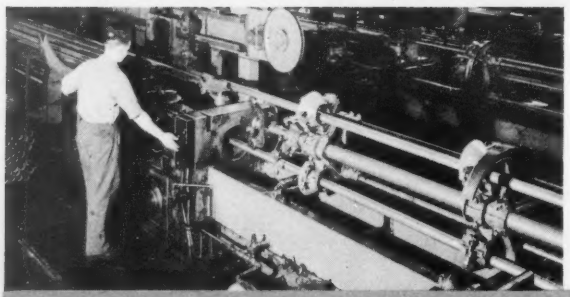

The VAUGHN MACHINERY COMPANY

CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

Litho in

used, e.g., saying that a die drew 5 pounds of wire makes sense only if at the same time the limits of electrical resistance or the size are mentioned, and the statement made that the die is used as a finishing die only or as a line die as well. The condition of the die after finishing of the drawing should also be stated.

✦ ✦ ✦

THE nickel chromium and also constantan wires are all to be supplied within certain electrical resistance limits. The size of tungsten wire and molybdenum is internationally given by weight in milligrams per 200 millimeters length. It, therefore, seems to be logical to express the die wear in feet per ohm resistance for every size or group of sizes. A die used as a finishing die may draw only one pound of wire and it still can be a good die. An example may illustrate this further.

SUPPOSE a certain wire is to be supplied in ohms per foot between 300 ohms and 350 ohms. But a finishing die at the start happens to be 330 ohms. Consequently, this die has 30 ohms to go and provided its quality (shape) allows us to use it that long, we will be able to say that 30 ohms drew 300,000 feet of wire. Therefore, per ohm we drew 10,000 feet.

✦ ✦ ✦

RESISTANCE is proportional to cross section regardless of shape but this does not mean that from other viewpoints the use of a badly shaped die (see Figs. 2a & 2b) can be allowed (enamelling). If the here described suggestion was accepted, interesting figures would be made available because in this way it would be possible to compare the lubricants, quality of die makes, etc.

THE graph shown in Fig. 3 gives an interesting picture of the behavior of this particular die during its use.

✦ ✦ ✦

ANOTHER much desired improvement could be made if it could be agreed upon between manufacturers and users to standardize all resistance limits for the nominal sizes. Consider the sizes .001", .0011", .0012", .0013", .0014", and .0015". The resistance could run approximately as follows:—

.001"	600 - 700
.0011"	500 - 600
.0012"	425 - 500
.0013"	350 - 425
.0014"	300 - 350
.0015"	250 - 300

✦ ✦ ✦

THE advantage is apparent. In so doing a die which starts off at 450 ohms would be of .0012"

(Please turn to Page 739)

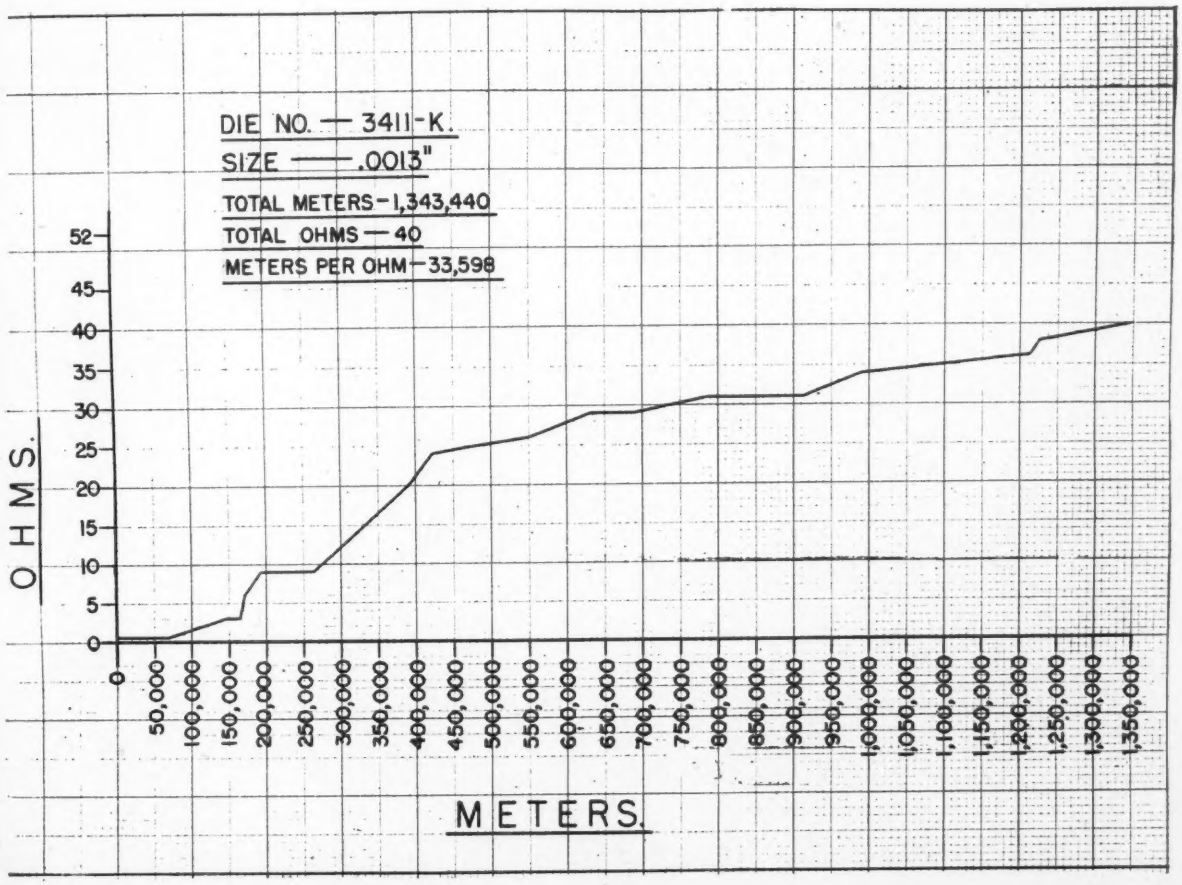

Fig. 3. Graph shows wear on a specific die after various quantities of wire had been drawn.

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Tallest Stack East of the Mississippi

MADE WITH

SAUEREISEN NO. 31 ACID-PROOF CEMENT

RIVALS HEIGHT OF WASHINGTON MONUMENT!

Washington Monument, the World's largest stone and masonry structure, towers 550 feet into the sky. The stack, pictured here, was recently erected in Pennsylvania. It is 500 feet high and was lined with acid-proof brick, laid in Sauereisen No. 31 Acid-Proof Cement. Over 480,000 lbs. of Sauereisen Acid-Proof Cement No. 31 was used on this job.

USED ON THE BIGGEST JOBS

This is just one example of hundreds of case histories in our files that demonstrate the satisfaction large users obtain from this superior acid-proof cement. Thousands of tons are now in place on masonry constructed tanks, towers, vats, pits, floors, filters, and receivers. Sauereisen No. 31 cement has application in virtually every industry where protection against corrosive and erosive elements is needed. Chemical plants, steel mills, refineries, textile plants, paper mills, sewage disposal plants, distilleries, etc.—all rely on this acid-resistant bonding material. Also useful on technical assembling, etc.

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Sauereisen No. 31 Acid-Proof Cement hardens rapidly but remains soft and pliable enough to permit ample time for handling. It is ready to use by simply mixing a powder and liquid. Applies like ordinary mortar. It is the strongest sodium silicate cement available for acid-proofing.

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This cement has three to four times the adhesive strength of other cements on brick, tile, iron, steel, wood, or glass; yet, it is sufficiently elastic to resist strains caused by temperature variations.

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A new plant recently completed and equipped with the most modern facilities makes possible prompt shipment of any quantity. A trial order must convince or there will be no charge.

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Developing A Safety Program In Wire Mills

By Robert H. Ferguson,
Manager of Safety, Republic Steel Corporation,
Cleveland, Ohio.

The staggering losses to production in man days and man hours every year as a result of injuries on the job make this discussion very pertinent in these days of crucial man power shortages. ✦ ✦ ✦ ✦
In this article Mr. Ferguson brings the practical application of "Safety in Production" to the fore. By showing the importance of (1) building and designing safety into the operation, (2) suggesting methods of developing the program, and (3) stressing the job management must do in the program by leadership he demonstrates the practical value of safety training. ✦ ✦ ✦ ✦ ✦

OCCUPATIONAL accidents continued to exact a high toll of death and injury from those engaged in industry during 1943.

✦ ✦ ✦

HAVE you any idea how many deaths occurred on the job in 1943? Can you estimate accurately the number of non-fatal injuries to workers last year? What do you believe the total estimated costs of these accidents, both direct and indirect, to be for 1943?

✦ ✦ ✦

SUPPOSE we look at the facts as set forth by the **National Safety Council.** In 1943 there were 18,000 fatal accidents on the job to those employed in industry. During the same period 1,850,000 employees in this country were injured as the result of accidents arising from the job—with a loss of two hundred and seventy million man days. The total economic loss last year is placed at $2,400,000,000.

✦ ✦ ✦

CONSEQUENTLY, there can be little argument against a well-balanced safety program. Such work is not only a necessity from the humanitarian standpoint, but the needless wasteful economic drain must have the personal attention of every thinking business executive.

✦ ✦ ✦

EVEN as we talk here somewhere a worker has been killed, yes—every 29 minutes a fatal accident occurs, and every seventeen seconds someone is injured.

✦ ✦ ✦

WIRE mills are currently averaging about 8.5 for frequency and 1.1 for severity. The average frequency rate for all industries in 1943 was 14.52 and the average severity rate was 1.20. Injury rates for the fabrication of structural steel, bolt and nuts, chain, forgings, and other similar products averaged about 15.5 for frequency and 1.2 for severity.

ROBERT H. FERGUSON,
Manager of Safety, Republic Steel Corporation,
Cleveland, Ohio.

Mr. Ferguson has had a broad experience in Safety work, coming to Republic after serving as Staff Safety Engineer for the National Safety Council. He has served as President of the Society of Ohio Safety Engineers, as Vice-Chairman of the Metals Section of the National Safety Council, and as a member of the Executive Committee of the American Society of Safety Engineers.

IMPROVEMENT in the injury rates of rod and wire mills since 1929 has not kept pace with the reductions attained in some of the other major departments. The decrease in frequency rate during past years has amounted to 41 per cent whereas this rate is down 78 per cent in sheet mills, 62 per cent in open hearth, 60 per cent in general mechanical and 54 per cent in pipe mills. The net reduction in severity has been 38 per cent since 1929 in comparison with decreases of 72 per cent for sheet mills, 81 per cent for open hearth and 55 per cent for blast furnaces.

✦ ✦ ✦

THERE are three classical ways to face the Safety problem. One is to pray God to be kind. The second is just to leave it to the insurance coverage. The third is to develop a program to stop the injuries, accidents, fire, etc. The first technique represents more hope than faith; the second parallels the ostrich in hiding and the third—well that is the development of a program—headed by management—designed **to stop** the accidents. It is a program which sometimes comes slowly, like the dawn of a new day, to mark an era in the history of man's humanity to man.

✦ ✦ ✦

SAFETY is also good business—which to most of us is in itself sufficient justification.

✦ ✦ ✦

AT the risk of repeating some of the remarks made before this group several years ago, I believe we should base our discussion on two premises: (1) That safety is management's responsibility, and (2) that Safety is an operat-

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MONTHLY ACCIDENT REPORT

UNIT _____ MONTH _____ 194

UNIT	HOURS WORKED		NO. OF LOST TIME ACCIDENTS						TOTAL DAYS LOST		FREQUENCY			SEVERITY		
			PERMANENT DISABILITIES		FATAL		TOTAL LOST TIME ACCIDENTS				NUMBER OF ACCIDENTS PER 1,000,000 HOURS TO DATE			DAYS LOST PER 1,000 HOURS TO DATE		
	MONTH	YR TO DATE	MO.	YR.	MO.	YR.	MO.	YR.	MONTH	YR TO DATE	THIS MONTH	THIS YEAR	PREVIOUS YEAR	THIS MONTH	THIS YEAR	PREVIOUS YEAR

FREQUENCY = $\frac{\text{NUMBER OF LOST TIME ACCIDENTS} \times 1,000,000}{\text{MAN HOURS WORKED}}$

SEVERITY = $\frac{\text{NUMBER OF DAYS LOST} \times 1,000}{\text{MAN HOURS WORKED}}$

REPUBLIC STEEL CORPORATION AND SUBSIDIARIES
SAFETY DEPARTMENT

ing problem. Successful programs have established these as facts.

✦ ✦ ✦

TO plan our safety program intelligently it is essential that we be armed with the facts concerning the accident experience of a given plant. So that we may be on a comparable statistical basis it is suggested that the **American Standard Association Code, "Reporting Industrial Injuries"** be followed carefully. By a study of this code we quickly note that a lost-time accident is defined as one "where an injured person cannot return to a regularly established job on the next calendar day".

✦ ✦ ✦

A STUDY of the code will also reveal the proper method of compiling statistics so that we may determine our frequency and severity rates so as to have a yardstick of comparison. Frequency is the number of lost-time accidents multiplied by 1,000,000 and divided by the man-hours worked. It shows the number of injuries per million man-hours. Severity is the number of days lost multiplied by 1000 and divided by man-hours. It gives the number of accidents per 1000 hours worked.

✦ ✦ ✦

A REAL safety program must be thorough—that is it must cover all phases of the work from the time the raw material enters the plant until the finished product is shipped. Moreover, the Safety program must include every employee on the payroll from office workers to labor and the boss.

✦ ✦ ✦

The Four E's of Safety

PERHAPS the best way to discuss our problem is to consider the four E's of Safety. These are: (1) Engineering, (2) Education, (3) Enforcement, and (4) Enthusiasm.

✦ ✦ ✦

Engineering

THIS approach is consistent with good practice We must build plants with the safety and well-being of our working personnel in mind. It is just as simple to construct a plant the right way as to build dangers into a building and operations which a little foresight could have eliminated. To do this job representatives of our engineering departments sit down with the Safety man and review the best known practices, check the safety codes, both state and national, and agree on the structure to be recommended. Blueprints are checked for safety and for legal requirements of the jurisdiction in which the plant is located. This is important. There are many instances on record where buildings have been constructed in violation of the law and have had to have costly changes made later. Again —it is well to get all safety charges in against an appropriation at the time of building—if this is not done the machine guarding, the proper structure, standard clearances, efficient lighting, etc., for safety, will either be taken on costs or not done at all—thus leaving needless hazards and accident traps to catch the man on the job.

✦ ✦ ✦

ONE example of normal safety and usual state code requirements which should be followed closely is a standard handrail for stairways or floor openings. These rails are 42″ in height with an intermediate rail and a six inch toe board. Stairways should have certain width treads and risers of standard height.

✦ ✦ ✦

THE present structure of old plants as well as new buildings should be made safe. If this is done properly management has by the same token given its sincere pledge to do a job for safety.

✦ ✦ ✦

Education

TOO many times in the safety field all of the educational work is directed towards the man on the job. The weakness is evident because management, supervision and men alike must take an active part for safety. All are part of the same organization for production. All must do their part for a suc-

cessful accident prevention program.

✦ ✦ ✦

Safety Is Management's Responsibility

THE leadership for safety must come from management. The program must have the active attention of the top flight officers. Lip service alone is not sufficient.

✦ ✦ ✦

TO do this we suggest a safety organization be set up to fit the particular plant. One man should be made responsible for the program. This man should report directly to the plant manager.

✦ ✦ ✦

MEETINGS for the purpose of developing policy and educating men in safe practices should be set up. We suggest:

1. An Executive Safety Committee

THIS group should be made up of the plant manager and all his department heads. This committee has the "say so" on policy matters as affects the entire program, should plan the specific program to be carried on in the plant and then see that it is carried out. This committee should meet once each month on a regularly scheduled date.

✦ ✦ ✦

2. A Departmental Safety Committee

EACH department head should meet once each month with his supervisors. This group carries out the work laid out by the executive committee and further develops specific safety educational work within its own department to be discussed by each foreman with his men. The work of planning jobs for safety and eliminating unsafe practices in the shop must receive much attention.

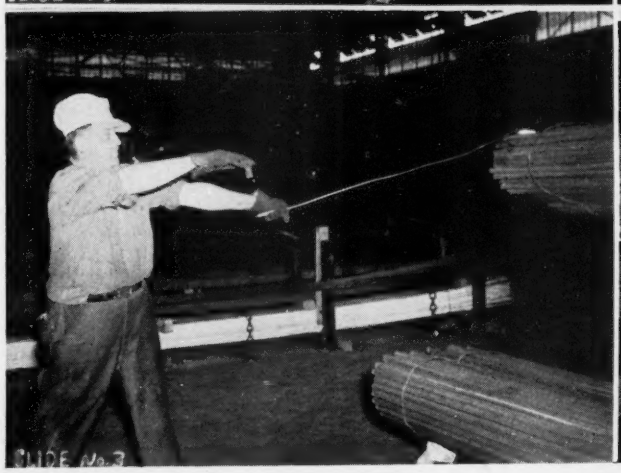
✦ ✦ ✦

3. A Foreman's Safety Meeting

EVERY foreman or other supervisor should meet once each month with the personnel for which he is responsible and discuss the specific safety problems of the job. Here the foreman has the real opportunity to analyze the dangers of the jobs—determine "just what are the hazards" and "what can I do about them". In other words the importance of job study or job analysis will not only reveal possible hazards, but will automatically suggest safe practices to be considered.

✦ ✦ ✦

IN addition to these educational activities it is advisable to use



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safety posters. Such posters should be neatly displayed and changed regularly—in other words such material should be attractive and create interest in the problems at hand.

✦ ✦ ✦

OF vital importance also is the use of practical safety rules for the plant. These safety rules should be in the form of safety instructions. Rules are best compiled from lessons learned from accidents which have already occurred in the plant or other operations and from recommended good practice. Safety rules should be explained so that they are thoroughly understood. Only when this is done can proper enforcement and intelligent application be obtained.

✦ ✦ ✦

Personal Safety Equipment

NO detailed discussion on this phase of safety is intended in these remarks. Only typical equipment is mentioned. There are many other examples.) The proper use of eye protection, both special and regular cannot be over-emphasized. This requires thorough education and selling to get enforcement. There are two important factors in this program. One, there can be no exceptions to the rules. If men are required to wear goggles—then all supervisors and visitors should do likewise. Two, when goggles are properly fitted you will find that most of the difficulty and complaints about them will be eliminated.

✦ ✦ ✦

SAFETY shoes, another form of protective equipment, do prevent accidents. Proper fitting from a sufficient shoe inventory makes it possible to get good footwear on every person in the plant. These shoes, sold at cost, are as good or better than any on the market. The ration stamp problem may present some difficulty, but your ration board will be glad to help you.

✦ ✦ ✦

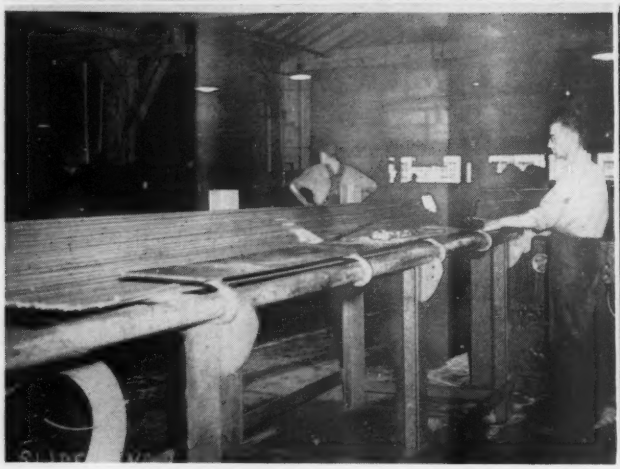
HAIR covering, safe shoes and proper clothes for women are as important as proper sanitation facilities. I recognize that it is not always easy to sell women on the hazards of wearing jewelry on the job, for example. But we all know that to permit this is dangerous and must not be overlooked nor allowed.

✦ ✦ ✦

SUPPOSE we consider some accidents of recent years in the wire industry and discuss methods of prevention. Our comments will be directed to both practices and conditions.

Slide 1. This man is guiding a lift of rods with his hands.

Slide 2. And this worker has his hand on the links of the chain. Both are



For description of photographs, see text. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

poor practice as when the chains tighten and the lift shifts, off come the fingers.

Slide 3. This man is using a hook to guide the lift—note he is in the clear—his hands and fingers are out of danger.

Slide 4. These men are placing wire around bundles. You will note they are wearing goggles. Last year we experienced six accidents where the bundling wire flew up and hit men in the face. There was no loss of eyes because the men wore goggles.

Slide 5. Projecting bars in rough stock storage have caused accidents. Good housekeeping and proper storage have minimized such injuries. Note the bar is at eye height.

Slide 6. Locking out equipment when it is necessary to repair or adjust machinery is very important. If this rule is followed as it should be the machine on which this man is working cannot be started until he removes the lock. He has the only key.

Slide 7. Whipping bars at the entrance end of Taylor-Wilson straightener caused much concern until the tube shown here was developed. This protects the operator and makes for more confidence in the job.

Slide 8. When sampling acid or handling small quantities, a carrying case such as shown is used. We bind this box with copper wire or strip as acid destroys wood and if the carrier fails, the bottles drop out and break.

Slide 9. Here is an accident which resulted in the loss of a finger. It is poor practice to place the hand here as noted. This man was feeling the wire—his glove caught and his hand was pulled under the wire on the drum.

Slide 10. Lewis straightener showing open-hinged guard over feed rolls.

Slide 11. This view shows the guard in the closed position.

Slide 12. Here the wire has passed through the straight-and-cut machine and is dropping on to the truck. Note the side stops. The development of proper stops on tables and trucks will save many fingers.

Slide 13. Here is a straight-sided chain used on Vaughn Block for pulling wire through die blocks. This chain was developed after a wire drawer lost a finger between puller grip and drum when grip turned over because of twist in chain.

Slide 14. Chain attached to end of coil and ready for draw.

Slide 15. Note chain raises with coil on drum as stock feeds on the bottom of drum as it is being drawn.

Slide 16. Tractors are indispensable and need to be no source of accident if handled properly. The type illustrated is equipped with "dead man" controls and the operator is located in a safe position. These few illustrations were selected at random to show the importance of certain types of guards and methods to be used by supervision to detect and correct unsafe practices.

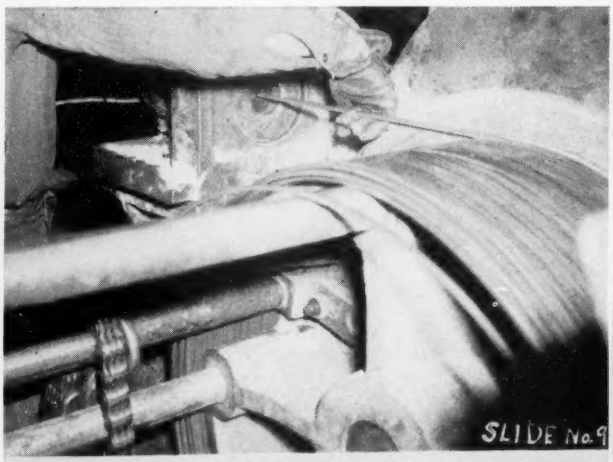
Slide 17. Handling acid is hazardous unless proper precautions are followed. Note this man is wearing acid goggles. His rubber boots are on the inside of his trousers, his gloves on the inside of his shirt sleeves — reason — to prevent acid, in event of a spill, from going into cuff of glove or into boot.

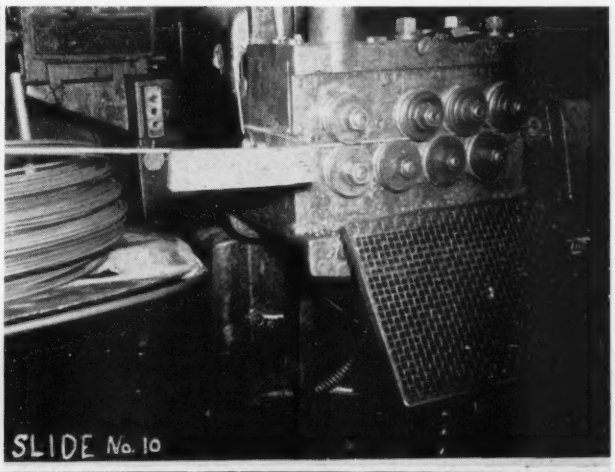
Slide 18. Safety latch on crane hook as shown prevents the "stiff leg" from becoming disengaged from the hook and turning over on the crane follower.

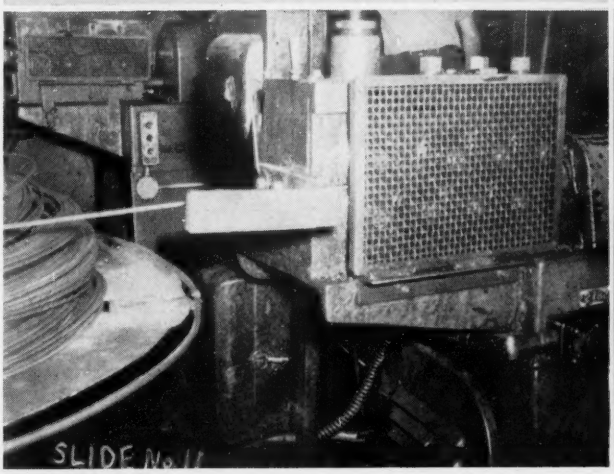
✦ ✦ ✦

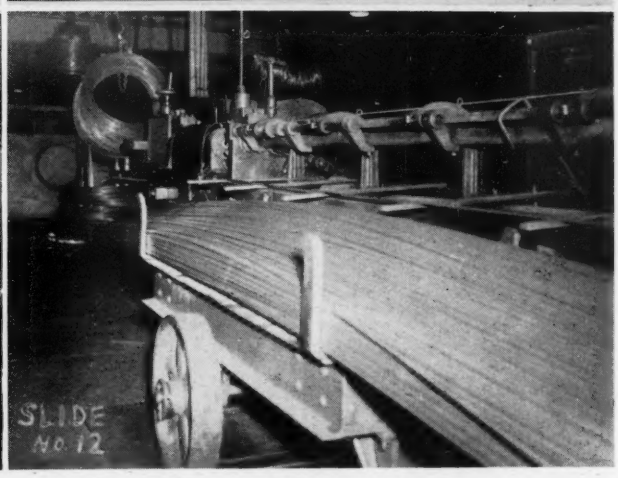
LET me list seven lost-time cases that have come to my attention and point out the methods followed in each instance to prevent recurrences.

1. Bar Pickler attempted to move lift chain under pickling machine chain while pickling machine was in operation. He caught hand between pickling machine and sheave. Severely crushed left hand — index finger amputated. Instructions issued that pickling machine must be locked out before lift chains are moved.





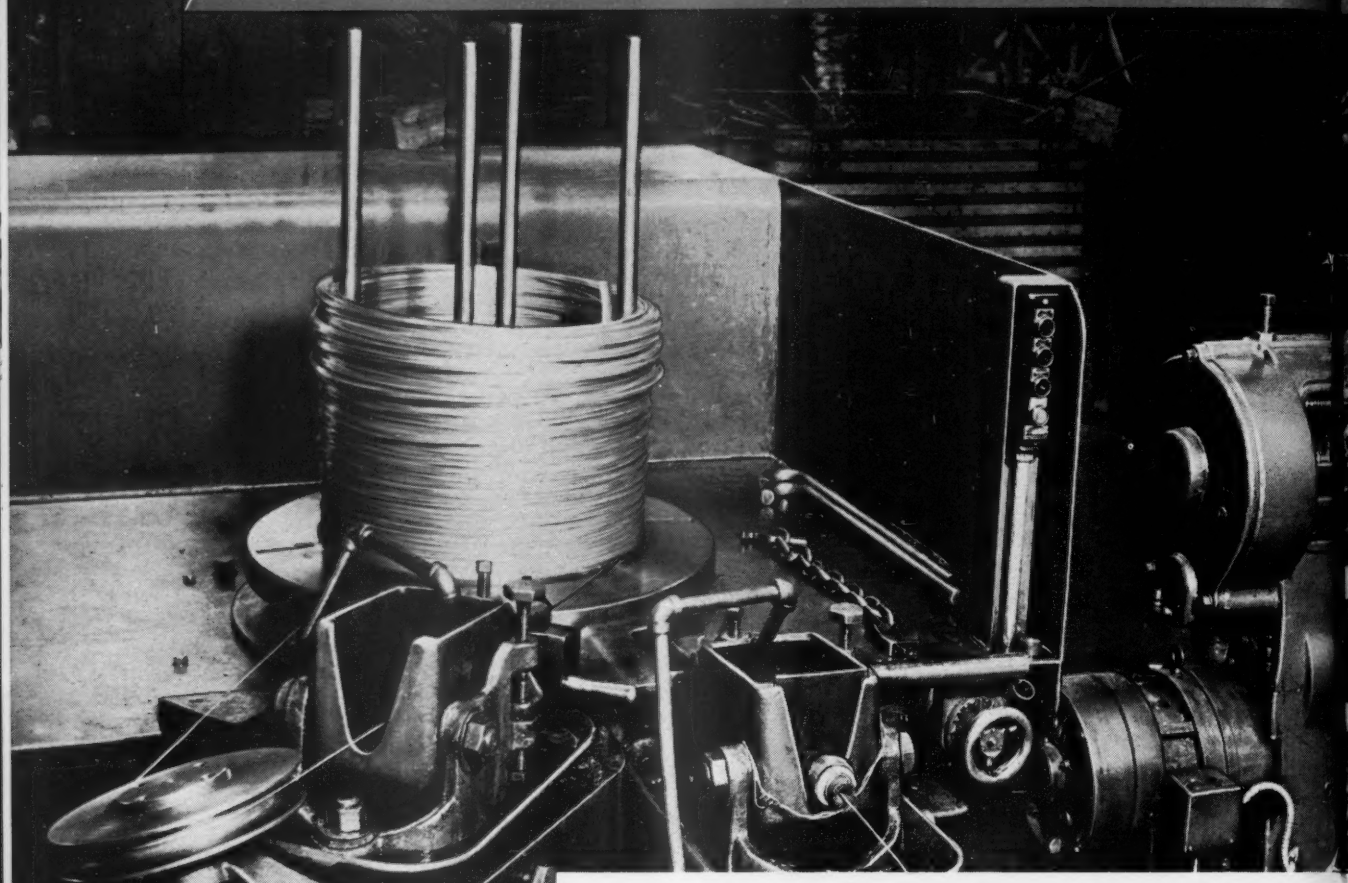




For description of photographs, see text. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

Firthaloy SERVICE IS "C

From Smallest Wire Mills



Photos by courtesy of The Vaughn Machinery Company.

When you ask for FIRTHALOY Service, a man with special experience in your field is sent. The FIRTHALOY Service Man studies your mill and co-operates with your die room. He is prepared to teach operators and also to work with them on problems peculiar to the individual mill. Even the smallest mill receives the same caliber

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ARMY E NAVY

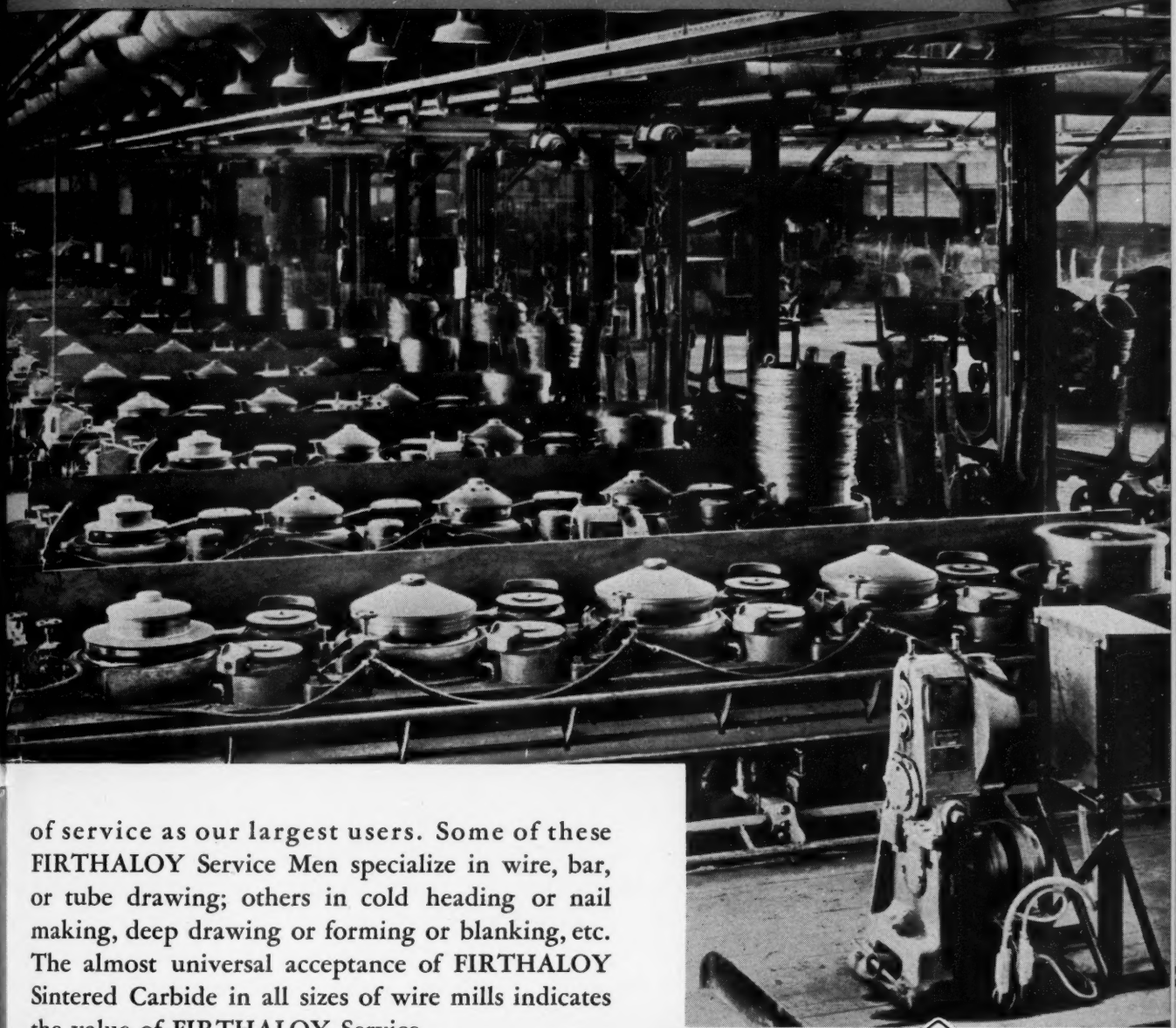
Firth-Sterling
STEEL COMPANY

Offices: McKEESPORT, PA. - NEW YORK - HARTFORD - PHILADELPHIA - PITTSBURGH - CLEVELAND - DAYTON DETROIT - CHICAGO - LOS ANGELES

Offices:

"Custom-Made" SERVICE

to Largest Wire Mills . . .



of service as our largest users. Some of these FIRTHALOY Service Men specialize in wire, bar, or tube drawing; others in cold heading or nail making, deep drawing or forming or blanking, etc. The almost universal acceptance of FIRTHALOY Sintered Carbide in all sizes of wire mills indicates the value of FIRTHALOY Service.

FIRTH-STERLING FIRTHALOY QUALITY

"THE STANDARD CARBIDE"

Firth-Sterling
STEEL COMPANY

Offices: McKEESPORT, PA. - NEW YORK - HARTFORD - PHILADELPHIA - PITTSBURGH - CLEVELAND - DAYTON - DETROIT - CHICAGO - LOS ANGELES

2. Laborer unloading bars into box car, bar weighing 148 pounds, fell three feet off truck, hitting right foot. Injured man was wearing safety shoes; but bar hit back of safety cap, bruising instep right foot, fractured right 2nd metatarsal. This truck was loaded above the truck standards—orders have been issued that bars are not to be placed above top of standards.

3. Stocker jumped off rack 10 feet high to ground floor to avoid being hit by spreader chain which caught on the wire on top of steel pile and swung toward him. All cranemen were instructed to lift spreader into the clear before traveling.

4. Machinist was operating a motor-driven lathe. He stopped machine and started to shift his belt with his right hand when he accidentally hit switch with his body, throwing it on the ON position. Machine started and his right hand was caught between the belt and pulley, twisting his right lower arm. The rule regarding locking out switches when working on machinery was not followed. We have, however, installed guards around switches so they cannot be moved by operator's body.

5. Centerless Grinder Operator was helping to turn short bars on the turning machine. Operator and injured man were hooking up chains on bar to move it with crane when bar rolled off onto floor. Operator was in clear, but injured man was not. Injured man jumped back and hit his heel on steel bench, fracturing left heel. This accident was caused by two unsafe practices. Operator should not have loosened up bar until crane chains were attached and injured man should have stood in the clear. Foremen should enforce safe practices.

6. Scaler Operator was pushing a truck loaded with steel bars from acid-pointing tubs. He put his foot up against toe board around pointing tub. His foot slipped over toe board and into hot sulphuric acid, causing burns to right ankle. Height of the toe board was increased from 3" to 7". However, this will not completely eliminate a recurrence of this kind of mishap unless such unsafe practices are further drilled into men's minds by education.

7. Rackman was unhooking a lift of steel in one rack when a short bar of 2" round steel rolled from rack next to him, hitting left ankle and foot and causing severe bruise over left metatarsus. Orders were issued that all short bars should be securely wired to prevent shifting.

✦ ✦ ✦

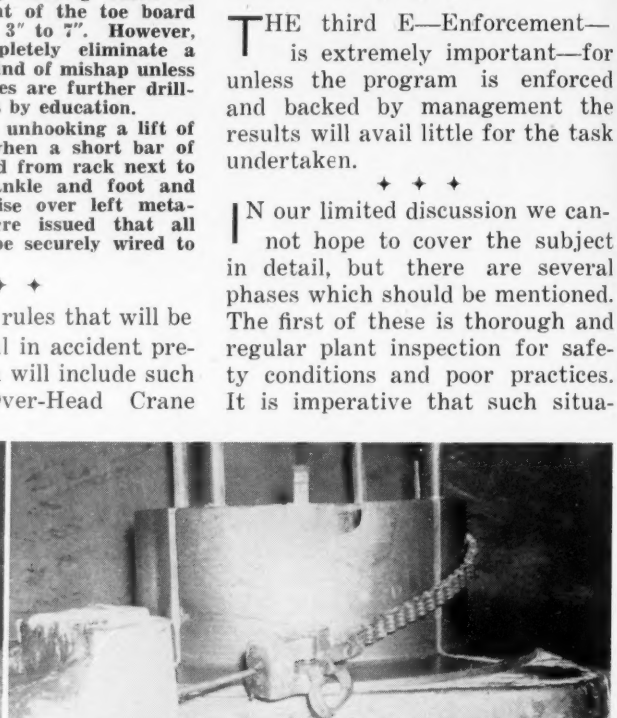
EXAMPLES of rules that will be found useful in accident prevention education will include such booklets as "Over-Head Crane Rules"—Exhibit 1; "Gas and Electric Cutting and Welding"—see Exhibit II; "Handling Flammable Liquids," see Exhibit III; "Rules for Gas and Oil Fired Furnaces", see Exhibit IV. These again are typical examples of the vast amount of information available to aid you in the many problems of safe operations.

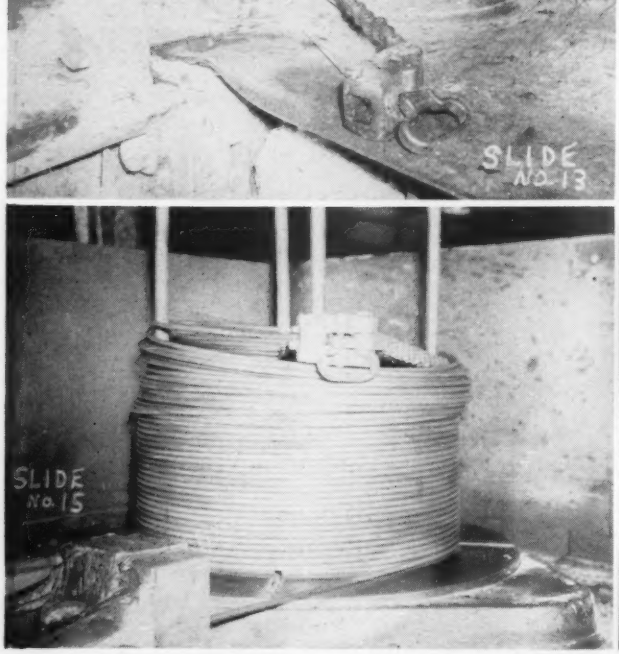
✦ ✦ ✦

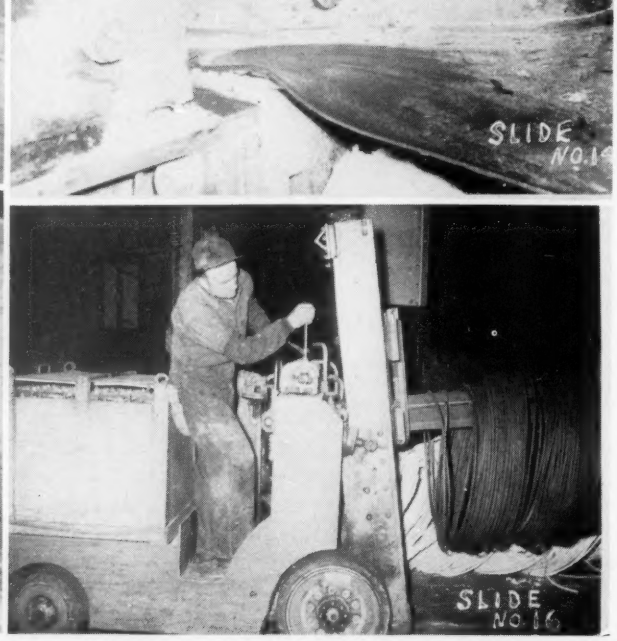
THE third E—Enforcement—is extremely important—for unless the program is enforced and backed by management the results will avail little for the task undertaken.

✦ ✦ ✦

IN our limited discussion we cannot hope to cover the subject in detail, but there are several phases which should be mentioned. The first of these is thorough and regular plant inspection for safety conditions and poor practices. It is imperative that such situa-







For description of photographs, see text. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

tions be corrected promptly. Routine inspections by the plant safety man in company with the departmental superintendent and foreman have a definite effect on the reaction of personnel. When correcting poor practices, supervisors must be fair and just. It serves little purpose to correct a practice if a bad taste is left in a man's mouth and the reasons for changing a practice are not explained to him in full detail.

✦ ✦ ✦

SAFETY rules can be very helpful as mentioned before, but we must always be sure that the rules are practical, that supervision understands the instructions thoroughly and above all knows how the job should be done, believes in the safe methods and knows why the method is right. Believe me, gentlemen, your foreman will do a job for Safety if management indicates it really wants Safety and backs up the Safety Program.

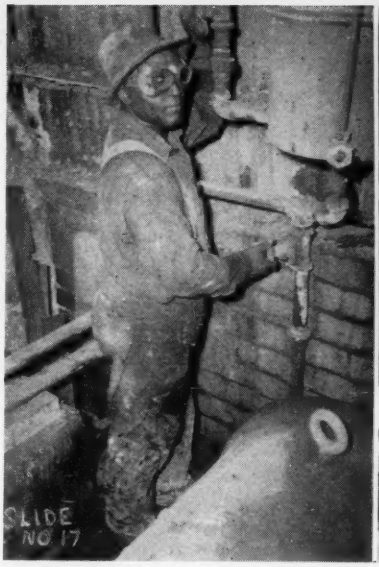
✦ ✦ ✦

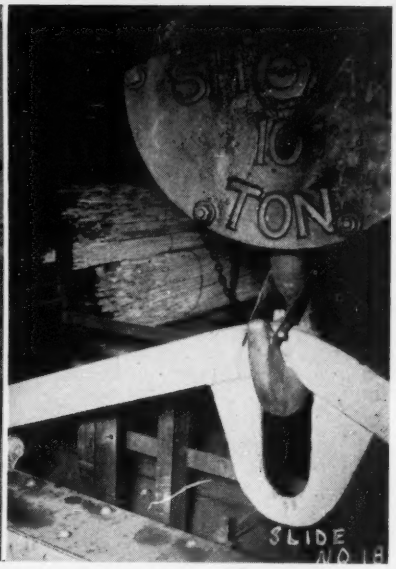
IN the enforcement program, the investigation of near accidents and accidents involving loss of time is very important. Three factors of checking will be found of aid: (1) Where was the injured working, (2) what was he doing, and (3) how was he hurt. There should never be a thorough check-up without a finding—with suggestions designed to prevent a recurrence. That is the lesson we should learn from such occurrences. These findings should be set up in rules, if necessary, and by all means should be discussed in all group safety meetings. It is by instruction and the exchange of experiences that we can best hope to prevent other personal injuries.

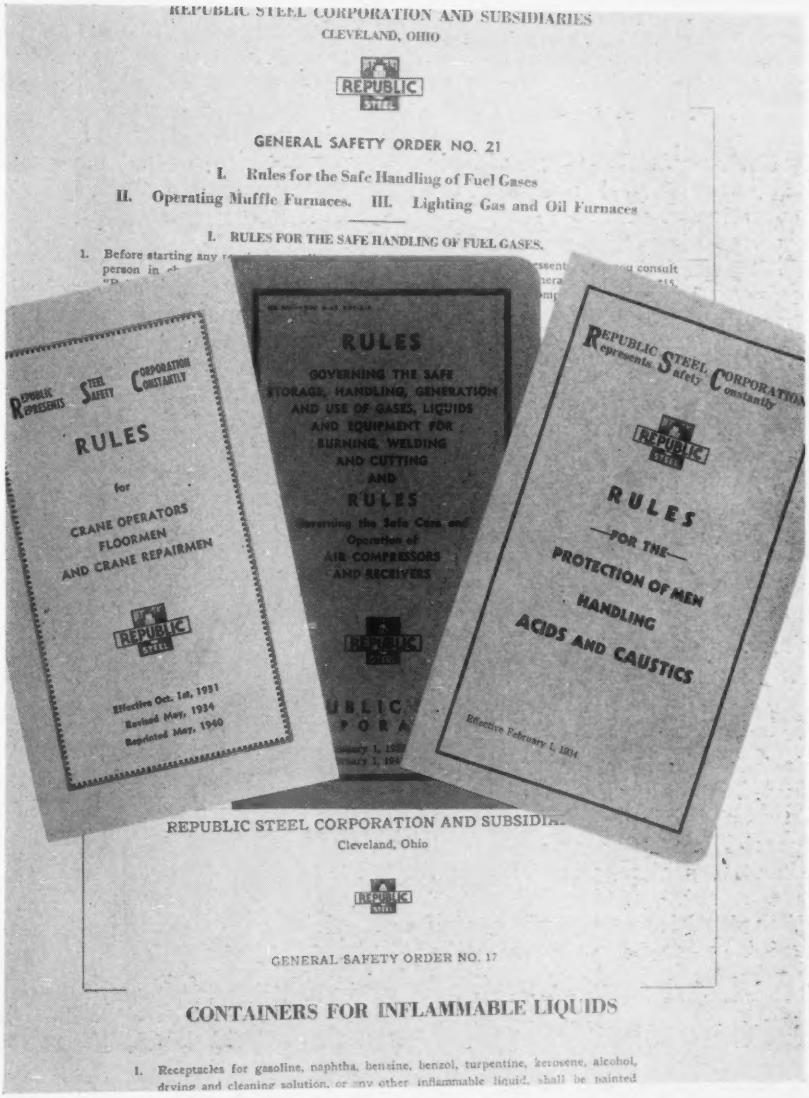
✦ ✦ ✦

THE fourth E—one most of us assume—can really lead to success and needs stimulus at all times. It stands for Enthusiasm—and it must come from active leadership by management. Such leadership must show by example that it means business in safety and is willing to do a job to prevent accidents. A real safety job

(Please turn to Page 739)







New Development In Plastic Insulating Materials

By Dr. John W. Shackelton, Ph.D.,
Plastics Department, E. I. duPont deNemours & Company,
Wilmington, Del.

Plastics are becoming increasingly more interesting as dielectrics or jackets for cables. Herein is presented a brief discussion of two new DuPont plastics, polythene and nylon. ✦ ✦ ✦ ✦ ✦ ✦

RESEARCH in the chemical industry has opened for manufacturers of insulated wire and cable a new field of dielectrics and jacketing compounds, which was expanded progressively during the past ten years. Particularly since 1940 have synthetic materials such as neoprene, vinyl chloride and the unplasticized resins, polythene and nylon, captured the interest of the cable manufacturers.

✦ ✦ ✦

PLASTICS and the synthetic rubber, neoprene, have established themselves as superior wire covering materials because of their inherent electrical and physical properties. Tremendous impetus has been given to the application of these synthetics to wire coating because of the current shortages of natural rubber, but plastics had been used in increasing quantities before the war, even in competition with rubber, and there is no doubt but that they will maintain their place in the post-war period as valuable insulations for special applications, as well as serious competitors of natural rubber.

✦ ✦ ✦

VINYL chloride resins have been employed by the wire and cable industry for some ten years. Although they possess only mediocre electrical properties, the "vinyls" can be compounded with plasticizers and other modifying ingredients to make very useful extruded insulations for low voltage wiring. Their flame resistance, when they are properly plasticized, is excellent, and by the use of other plasticizers, low temperature flexibility can be imparted to the compounds, although in the latter case the fire-proof qualities of the insulation or jacket is impaired. The vinyl chloride resins for wire coating have found their greatest usefulness as outer coverings or jackets over other primary insulations.

✦ ✦ ✦

A NUMBER of other thermoplastics, including ethyl cellulose, vinylidene chloride and cellulose acetate, have had more or less successful careers as wire coating compounds, although used in relatively small quantities.

✦ ✦ ✦

AMONG the synthetic rubbers, neoprene stands out as a protective cable sheath. It is applied by extrusion and then vulcanized in the well known "CV" machines. Neoprene is resistant to ozone and sunlight, moisture and most chemicals. It has good abrasion resistance and its general physical properties are excellent. To a large extent it has replaced fibrous coverings because of its permanence and good sheathing qualities.

✦ ✦ ✦

THE outstanding development of recent years in the application of synthetic materials to cable insulation is the new Du Pont plastic, polythene. Polythene is a generic name applied by Imperial Chemicals Industries, Ltd., and adopted by the **E. I. du Pont de Nemours & Company, Inc.,** to define those polymers of ethylene suitable for use in plastics.

✦ ✦ ✦

POLYTHENE was first developed in the laboratories of Imperial Chemical Industries, Ltd., and is manufactured under patents (U. S. 2153553 and 2188465) in this country by the Du Pont Company. The present production, which is considerable, is being used exclusively by the military services for cable insulation or in other critical electrical uses. It is under complete allocation by the **War Production Board** and is controlled by **W.P.B. Order M-348.** Sample quantities for experimental work are available on a limited scale, and with the end of the present hostilities polythene will undoubtedly be released on a production basis for the further development of many important peacetime uses.

✦ ✦ ✦

POLYTHENE'S remarkable dielectric properties alone mark it for an eminent place in the electric field. With a power factor of .0002-.0003 and a dielectric constant of 2.2-2.3, both properties measured over a wide range of frequencies, it suggested itself immediately as an insulation for high frequency applications. When its other properties are considered, it is easily seen why polythene is welcomed so enthusiastically by the cable industry.

✦ ✦ ✦

SLADE & CRAFTON[1] have listed twenty-three properties of polythene, which are of interest to wire coaters, for comparison with other dielectric materials. They note conclusively that polythene is rated "excellent" for eighteen and "good" for four of the twenty-three properties listed. All of the insulations compared, namely,

THE AUTHOR

DR. JOHN W. SHACKELTON, Ph.D.

Graduated from Vanderbilt University, Nashville, Tennessee, receiving a M.S. in Metallurgy there in 1933. Associated with the Du Pont Company since 1935, except for a period during which he held a teaching fellowship at the University of Illinois. He holds a Ph.D. degree in Organic Chemistry from the latter institution, doing his research work on the structure of polymers. He was technical service representative of the Du-Pont Plastics Department to the aircraft industry for two years, and for the past year has been doing technical service work on wire and cable coatings.

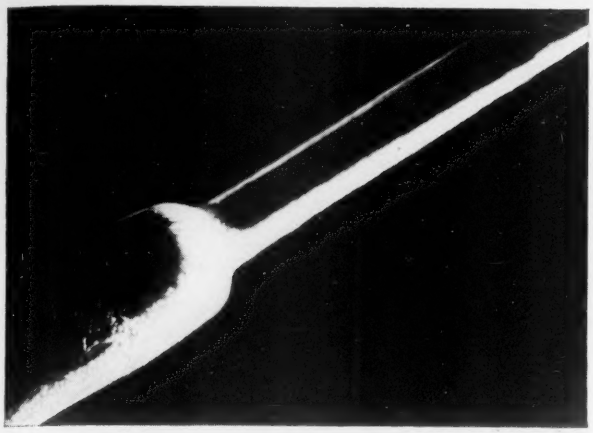


Fig. 1. Cold drawn fibre of polythene dark ground illumination. X80.

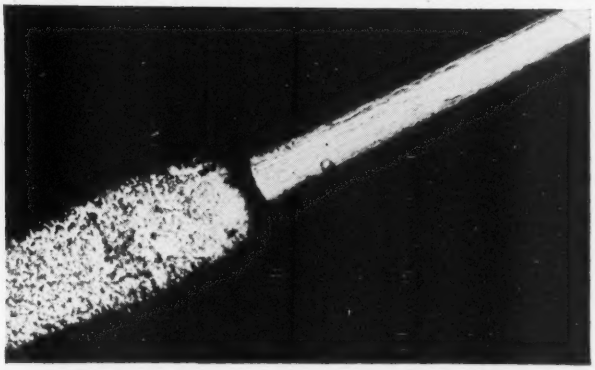


Fig. 2. Cold drawn fibre between crossed nichols in the 45° position, showing the difference between oriented and unoriented portions. ✦

polythene, polystyrene, polyisobutylene and rubber, were rated poor for flammability.

✦ ✦ ✦

OTHER electrical properties of polythene may be noted in the table of properties.

✦ ✦ ✦

THE water absorption of polythene is extremely low. The material is lighter than water and will float. It is resistant to most chemicals and solvents and has excellent weathering properties. Ozone does not affect it.

✦ ✦ ✦

THE mechanical properties are excellent from the standpoint of the cable manufacturer. Its low temperature flexibility and impact strength are remarkable when it is considered that polythene contains no plasticizer. It has a service temperature as an insulation higher than that of the vinyl chloride resins. At about 185° F. interesting changes take place in polythene. The material exhibits a transition from a crystalline to an amorphous state. This transition is manifested by marked changes in density, optical and electrical properties.

✦ ✦ ✦

POLYTHENE, like other crystalline plastics, can be cold drawn. A polythene filament can be elongated over the entire length up to a certain critical tensile value, normally about 1400 psi. After this value is reached the specimen separates into two regions, a drawn segment (about 4 to 1 elongation) and undrawn portions. The cold drawn filament then exhibits tensile values of higher magnitude due to the orientation of the crystalline structure. The tensile strength of drawn polythene may be as high as 15,000 psi.

✦ ✦ ✦

ORDINARY extrusion equipment may be used for the insulating and tubing of polythene. It is an easy matter to extrude or mold this plastic, although extensive mechanical development was necessary to adapt this new resin to H.F. cable because of the exacting physical qualities required in the finished product. Polythene is heat stable and can be left in the extrusion machine during shutdowns.

✦ ✦ ✦

AN antioxidant is added to polythene to prevent degradation of electrical properties, particularly the power factor, when the resin is exposed to elevated temperature for long periods.

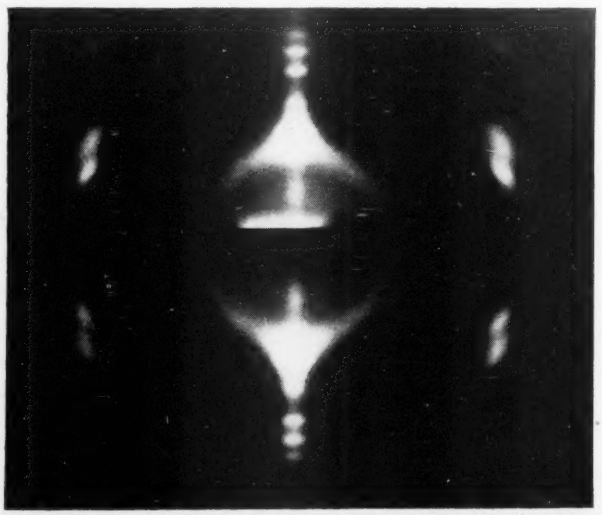


Fig. 3. X-ray picture of oriented thread showing fibre orientation. ✦

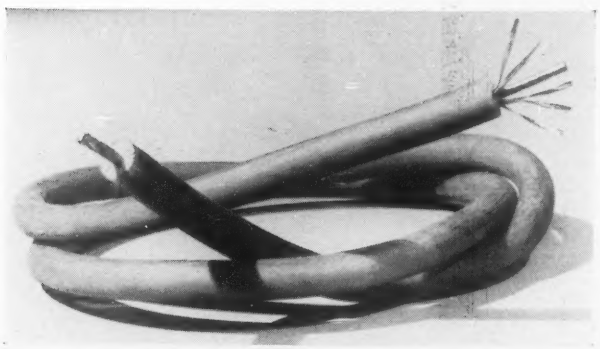
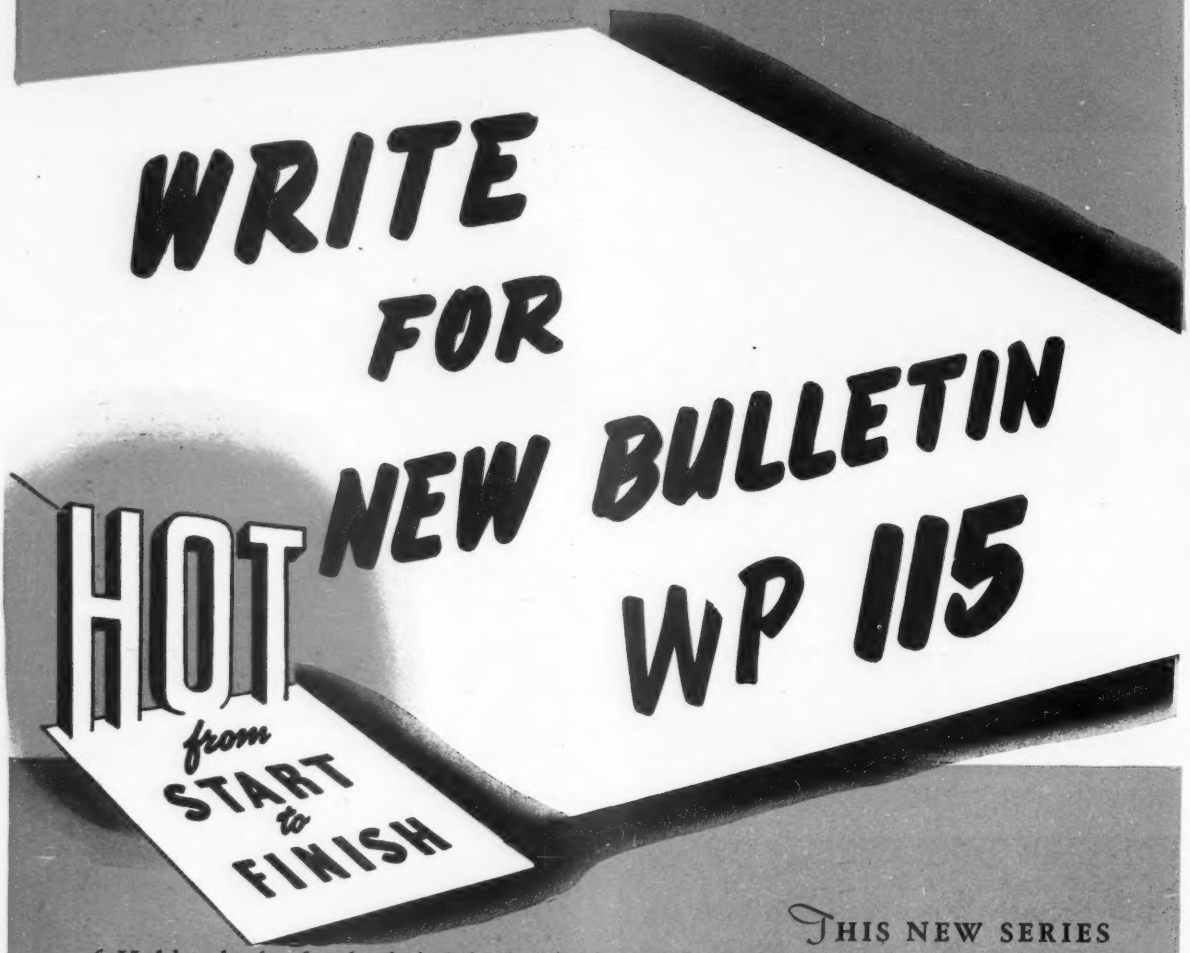


Fig. 4. A submarine cable core insulated with polythene plasticized with polyisobutylene, which shows the high flexibility. ✦ ✦

HOLDEN *Flow Heat Treatment*

For Bright Hardening, Bright Tempering and Hot Quenching

Also for Austempering, Martempering and Isothermal Heat Treating



THIS NEW SERIES of Holden baths for both bright hardening and bright tempering, regardless of temperatures, permits easy inspection of the finished product. By continuous research it has been possible to develop both high and low temperature baths. When parts are heated by these mediums they may be quenched into low temperature baths without sludging the bath. These low temperature baths may be used as quenching baths or tempering baths without producing any of the temper colors, and at the same time remove oxides.

Adaptable. Flow Heat Treating equipment is so designed that hot quenching and finish tempering may be done in a continuous operation. Steels that are too low in carbon for hot quenching may be quenched in oil or water and then tempered to produce a bright clean finish.

Production. This equipment is electrically heated, and is easily installed in your production line.

PHYSICALS

OBTAINED BY DIFFERENT FLOW QUENCHING PROCEDURES

TREATMENT						PHYSICALS				
High Heat Temperature	Time in High Heat in Min.	Quench Temperature	Time in Quench in Min.	Draw Temperature	Time in Draw in Min.	Elastic Limit P.S.I.	Ultimate Strength P.S.I.	Reduction in Area %	% Elongation in 2"	Rockwell C Hardness
NE 8744 STEEL										
1550°	12	650°	12	900°	12	149,000	168,500	57.0	15.0	30-32
1550°	12	650°	12			160,500	191,000	58.5	14.5	33-35
1550°	12	650	30			176,000	209,000	57.5	15.5	36-39
1550°	12	700	8			144,500	176,000	56.5	14.5	33-34
1550°	12	600°	20			195,000	239,500	53.5	13.0	42-44
SAE 4140 STEEL										
1550°	12	650°	12	900°	12	153,500	165,000	47.0	13.5	32-34
1550°	12	650°	12			157,000	190,500	47.5	13.0	35-37
1550°	12	700°	12			147,500	177,000	45.5	12.0	36
1550°	12	700°	7			152,500	181,500	51.5	13.5	36
NE 9430 STEEL										
1550°	12	650°	12	900°	12	142,000	157,500	60.5	16.0	28-30
1550°	12	650°	12			134,500	167,500	60.5	15.5	29-30
1550°	12	650°	30			167,000	190,500	59.0	14.5	34-36
1550°	12	700°	30			144,000	173,000	56.0	15.0	30-32
1550°	12	600°	20			180,000	221,500	56.0	13.5	37-39

Additional Steels for Flow Quenching

SAE 3140, 4047, 4130, 4135, 4340, 4640, 5140, 6140.
NE 8630, 8635, 8640, 8730, 8735, 8744, 9540, 9650.

Booth B 147...National Metal Congress

CLEVELAND . . . OCTOBER 16—20

THE A. F. HOLDEN COMPANY ● **NEW HAVEN 8, CONN.**

Metallurgical Engineers

Warehouses — Chicago, Detroit, Los Angeles
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POLYTHENE may be modified by the addition of other ingredients. It will be made available in a variety of colors, and a number of formulations adaptable to special uses can be expected as development work progresses in the use of such additives as gutta percha, raw natural rubber, paraffin, and the like. For example, a special "friction tape" is now being manufactured which has been enthusiastically received by cable manufacturers for the purpose of patching insulated wires of various types.

✦ ✦ ✦

Nylon

NYLON has been recognized for ten years as an unusual plastic. It has been best known in the forms of yarn, filaments and bristles. Important war uses, such as the manufacture of parachutes and glider tow ropes, replaced the hosiery and fabrics of peacetime. More recently nylon has been found to be an outstanding injection molding material and now it looms in its extruded form as a tough, abrasion-resistant compound suitable for the sheathing of cables or for the manufacture of tubing.

✦ ✦ ✦

NYLON, like polythene, is a generic name. It denotes a series of the polyamide type of resins which now number more than ten members, each having its specific use or field. Others are in the process of development.

✦ ✦ ✦

NYLON can be extruded in standard equipment with relatively simple dies. Because of its high softening temperature adequate heat must be supplied to the material as it passes through the equipment. The plastic is crystalline in nature and therefore has a sharp melting point. Above the melting point it is extremely fluid but solidifies quickly as it leaves the die.

✦ ✦ ✦

NYLON fibers have a melting point of 263° C. The particular nylon from which fibers are made is too fluid above the melting point to be successfully tubed in ordinary extrusion equipment. The excessive temperatures required and special handling techniques necessary make this type, as well as the type used for injection molding, unsuitable for wire coating. In certain special equipment, built exclusively for the purpose, some of the more fluid types are being extruded at high rates of speed.

✦ ✦ ✦

THE development of extrudable types of nylon has been the result of several years of research work. A nylon is now available which can be extruded in standard equipment at temperatures attainable by present commercial wire coating processes. On a commercial machine having a 2″ diameter screw, our laboratories have extruded nylon jackets 7 mils in thickness (over-all diameter, e.g., 40 mils) at rates of speed over 1000 ft. per minute.

✦ ✦ ✦

THE die used is a modified, self-centering tubing design which allows for the free flowing qualities of the nylon. A tube of nylon is extruded and is laid snugly over the wire, the wall thickness being controlled primarily by the wire speed. Coatings of less than one mil thickness have been applied by this method.

✦ ✦ ✦

NYLON extrusion powder is sufficiently heat stable to be left

DUPONT

TYPICAL PROPERTIES OF POLYTHENE (1)		
SPECIFIC GRAVITY	.92 (2)	D 71-27
TENSILE STRENGTH -70, 77, 170°F PSI	5000, 1900, 700 (3)	D 638-42T
ELONGATION -70, 77, 170°F %	50 50 35	D 638-42T
TENSILE STRENGTH 6MO. 77°F PSI	*	
MODULUS OF ELASTICITY 77°F PSI	14,600	D 638-42T
FLEXURAL STRENGTH 77°F PSI	1,700	D 650-41T
FLEXURAL FATIGUE PSI	†	
STIFFNESS 77°F PSI	13,300	D 747-43T
IMPACT, IZOD -70, 77, 170°F FT-LBS/IN	.37 * (4) * (4)	D 256-43T
COMPRESSIVE STRENGTH PSI	†	
ROCKWELL	R27	D 229-43
CREEP IN FLEXURE	*	
TEAR RESISTANCE LBS/IN OF THICKNESS	440 (.075")	D 624-41T
SHEAR STRENGTH PSI	990 (.040")	(5)
FLOW TEMPERATURE °C	104	D 569-43
DEFORMATION UNDER LOAD 122°F %/ 158°F %	0.6 - 0.8	(6)
STRAIN RELEASE TEMPERATURE °F	165 - 180	Arl. M-15
YIELD TEMPERATURE °F	140	Arl. M-8
HEAT DISTORTION TEMPERATURE °F	*	
HEAT DISTORTION TEMPERATURE-LOW LOAD °F	122	(7)
SPECIFIC HEAT CAL/GM/°C	0.5	
COEFFICIENT OF EXPANSION PER F°	10.5×10^{-5}	D 696-42T
THERMAL CONDUCTIVITY-BTU/HR/FT²/°F/IN	2.4	Arl. P-32 (8)
DIELECTRIC STRENGTH, SHORT TIME -V/M	475 (0.125")	D 149-40T
" " , STEP BY STEP-V/M	†	
VOLUME RESISTIVITY OHM-CM.	$>10^{15}$	D 257-38
DIELECTRIC CONSTANT, 60, 10^3, 10^6, 10^8 CYCLES	2.3, 2.3, 2.3, 2.3	D 150-42T
POWER FACTOR, 60, 10^3, 10^6, 10^8 CYCLES	<0.0005	D 150-42T
INDEX OF REFRACTION No. 25°C	1.51	
LIGHT TRANSMISSION, TOTAL VISIBLE ILL.C %	*	
LIGHT TRANSMISSION, AT 4500Å %	*	
HAZE %	*	
MAR RESISTANCE %	*	
WATER ABSORPTION %	0.01	D 570-42
FLAMMABILITY IN/MIN	1.1 (.125") (9)	D 635-41T
ARLINGTON RESEARCH LABORATORY	REVISED JUNE 12, 1944	

M-1

TYPICAL PROPERTIES OF POLYTHENE (1)	
OUTDOOR EXPOSURE	Practically no change in the properties of material compounded with antioxidants (viz. standard electrical grade). Physical properties deteriorate slightly when antioxidants are not used.
ACCELERATED WEATHERING	
METHODS OF WORKING	Extrusion, Injection, Compression, Calender rolling
BASIC COLOR	White translucent. Tan to brown when compounded with antioxidant.
RESISTANT TO	Most chemical reagents at room temperatures. Very slowly attacked by concentrated nitric acid.
NOT RESISTANT TO	Aromatic, aliphatic or halogenated hydrocarbons.
OUTSTANDING FOR	Good chemical resistance, good electrical properties, cold toughness. Low moisture permeability.
MAJOR USES	Wire insulation
Notes:	1. 15,000-20,000 approximate molecular weight.
	2. Weighed in alcohol.
	3. Thin sheets D412, Die C, 1700-2400 psi, 200-600% El. (77°F).
	4. Did not break in 4 ft-lb. machine.
	5. Johnson Shear Jig.
	6. Proposed addition to Tentative Methods D-621-41T.
	7. Proposed revision of D648-41T, 66 psi.
	8. Cenco-Fitch Apparatus.
	9. 4.5 sq.in/min. D568-43 0.040 in.
	† Data to be obtained.
	* Test not applicable.
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in the extrusion machine during shut-downs. Unlike the chlorine containing compounds, there is no danger of degradation of the polymer if the temperature of the machine is dropped 25 to 50 degrees below the melting point of the compound. In this state the compound may be left in the machine several hours. Over long shut-down periods the material can be cooled and left in the machine indefinitely.

NYLON has been employed as a thin, tough, flexible jacket on wire. It contains no plasticizer and thus will not exude, therefore will not contaminate the insulation or other parts of the cable construction. It has been proposed as a sealing compound to fill the interstices between the individual wires of a multiple strand cable. It has been suggested as a barrier layer between other materials in the cable which might contaminate one another.

✦ ✦ ✦

NYLON extrusion compound is self-extinguishing after ignition by a free flame, which is subsequently removed. It is resistant to practically all solvents, one exception being alcohol. Its physical properties are excellent for wire coating and one of its outstanding virtues is its high heat resistance. The water absorption value is rather high for cable insulation but as a jacket this is of lesser consequence than if the material were to be offered as a primary insulation. Development work is in progress with the aim of producing nylon with a water absorption below 0.5%. The electrical properties of nylon leave much to be desired, but here again the use of nylon as a sheath more or less precludes the requisite of outstanding electrical properties in the material. Its chief advantages in wire coating lie in good solvent resistance, toughness and resistance to heat.

✦ ✦ ✦

THE complete list of properties of the most recently developed grade of nylon for extrusion applications has not been completed. These properties will be presented at the time this paper is delivered.

Bibliography

1. **H. C. Crafton & H. B. Slade; "Polythene A New Dielectric For Cables". A paper presented before the Society of the Plastics Industry, Chicago meeting, May, 1944. (Published in Modern Plastics Magazine—Vol. 21, No. 11, July, 1944.)**
2. **J. C. Swallow; Polythene. Endeavor Magazine (British) Vol. 3, No. 9, January, 1944.)**

ANNUAL MEDAL AWARD of the WIRE ASSOCIATION

All members of the Wire Association are cordially invited to submit technical papers either for publication in "WIRE & WIRE PRODUCTS" during the year or for presentation before the Annual Wire Association Convention.

✦ ✦ ✦

An annual medal will be awarded in each of the two major divisions of the activities of the Association.

✦ ✦ ✦

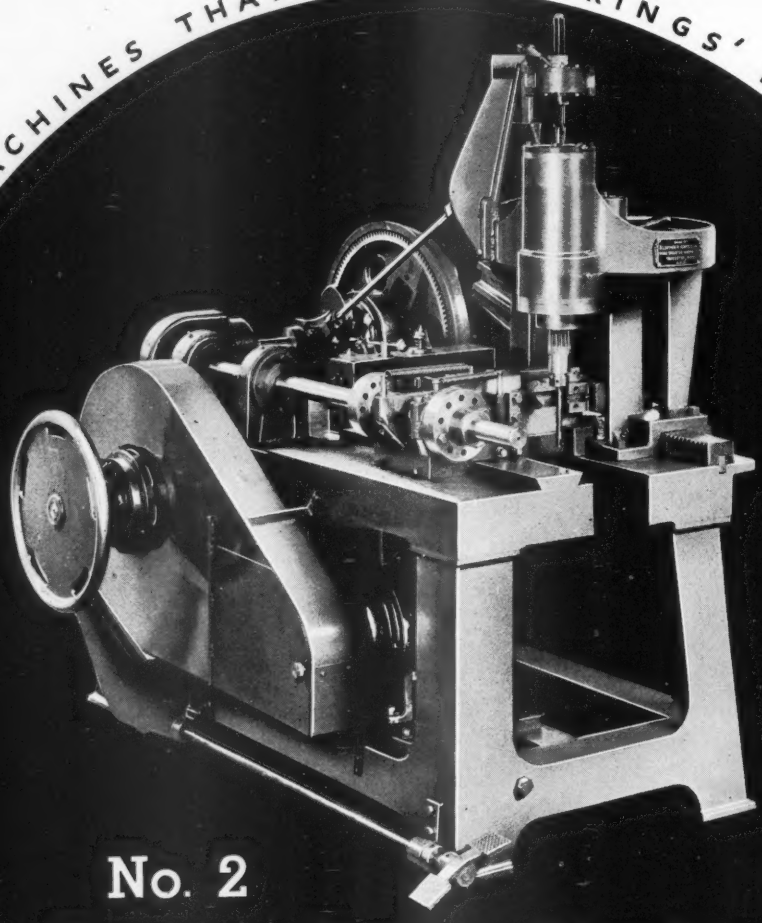
Consideration for the Medal Awards is not limited to the papers presented at the Annual Meeting, but is given to all papers contributed by members and published in "WIRE & WIRE PRODUCTS" during the year.

Selection of papers to be presented at the Annual Convention rests in the hands of the Joint Program Committee and the Board of Directors of the Wire Association.

✦ ✦ ✦

All papers submitted become the property of the Wire Association and the Board of Directors constitutes the Committee on Awards.

" THE MACHINES THAT PUT THE 'RINGS' IN SPRINGS "



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Cleaninghouse Practice

By F. P. Spruance,
Vice-President, American Chemical Paint Company,
Ambler, Pa.

SYNOPSIS

Except for the use of strong inhibitors, stable in hot acid, there have been no major changes in the chemistry of acid pickling. The introduction of these, however, ushered in a new pickling era, characterized by better and more economical pickling, in much improved equipment and with scientific supervision. Inhibitors are being generally used in the pickling of rods and wire, both of low and high carbon, and of alloys. In pickling some alloys, the acid attack and corresponding metal loss are substantially reduced, and pickled surfaces are improved by the addition, to the usual sulfuric acid pickle, of chloride ion and a suitable inhibitor. Improved practice of copper coating has resulted in better coated wire, facilitated drawing and extended die life. Whil copper coatings oxidize rapidly, their resistance to corrosion may be extended by a newly developed process which, with modification, may still further improve drawing. This treatment would be applicable as well, to the treatment of solid copper to retard corrosion and sulfide staining. ✦

Cleaninghouse Practice

THE chemistry of pickling in wire mills has changed little in the past twenty years. The removal of scale from wire, other than stainless, is still accomplished in sulfuric acid baths. Today these vary in strength from 3 to 12% by volume; however, concentrations of from 5 to 7% by volume might represent a fair average for wire pickling. Temperature as well as concentration is utilized in controlling the speed of pickling. The acid activity of a bath of given concentration can be quickly increased or decreased by raising or lowering its temperature, each change of 20°F. will approximately double or halve the activity. Temperature also has its effect on the nature of the pickled surface and while high temperatures, even in relatively strong baths, have little harmful effect on low carbon steels, high carbon and alloys are better pickled and freer from smut at relatively low temperatures.

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PICKLING time, which varies from ten minutes to an hour, depends, of course, on acid strength and temperature and on the type of steel and nature of the scale. Pickling time for low carbon is relatively short — twenty minutes, while that for high carbon and alloys may be an hour or more.

✦ ✦ ✦

Pickling Practice in the Past

WHILE the actual procedure for removing scale in the acid bath has changed little, pickling today is being intelligently supervised while twenty years ago there was almost no supervision. Then the boss pickler tasted the acid to determine its strength and added such amounts as, in his judgment, were needed to rejuvenate the bath. You, who can recall those pre-titration days, now realize the boss pickler's sense of taste or his judgment erred but always with the result that the acid was so strong and so hot that his pay envelope was as fat as it could safely be without endangering a change in the "rate".

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NOT only was the strength of the pickle left largely to the taste and judgment of the pickle boss, but the checks on his accuracy were inadequate. In even large mills acid was transferred from storage to pickle tanks in earthenware pitchers. In rare instances measuring tanks or "acid boxes" served to meter the acid on its way to the pickle tank. In neither case was the acid consumption per ton pickled too accurately known.

THE life of pickle baths was another matter lightly disposed of. It is true, hydometers were at times provided so the bath would not be discarded till its Baumé reached twenty or twenty-one degrees. This practice was often a source of acid waste rather than acid economy for, with a density of 21° Baumé baths were discarded with much too much acid and before there was nearly as much iron in them as the Baumé reading was calculated to indicate.

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ACID waste occurred not only in the supposedly spent bath but in over-pickling and too often in ruining the wire, to correct which, inhibitors that were stable in hot acid and exercised a positive control of the acid's action on the metal, were offered.

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PICKLERS twenty years ago were accustomed to dose pickle baths with "Red Dog Flour", wheat middlings, foul smelling glutenous ferments, sulfite pulp waste flour and liquor. Though these produced a foam blanket that held down acid fumes, none of them were effective inhibitors.

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Inhibitors Usher In A New Era

MILL chemists and production men were at first skeptical of the value of the new fangled inhibitors that sold for $4.00 or $5.00 a gallon. When they broke down and tested them they not only found the things worked, paid their way with the acid and metal saved, prevented over-pickling, produced better wire, etc., they also awakened to the fact that pickling had long been neglected, for there

were other and at times larger sources of waste that could be and should be stopped. They realized too that equipment and methods needed a thorough going over. **Thus did the inhibitor, indirectly as well as directly, usher in a new pickling era.**

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The Cleaninghouse Old and New

EQUIPMENT in the old days was as defective as were the methods. The circle of oval wood tubs, always leaking and enveloped in steam; the wood yokes jerked up, around and dropped into them by a rusty hand-operated boom; the floor—ankle deep with acid, lime, slime and fermenting swill; the backboard with the fire hose against which the coils were rinsed; the sull racks; the creaking buggies; the tunnel bakers in which these were buried for from eight to ten hours, are typical of the pickle house of the past. A few such are still to be found. Many, however, have been torn down and replaced with new ones in well built, well ventilated buildings.

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THE pickle house of today is a production line. Acid, rinse, lime tanks and bakers are set in a line past which an electric crane travels with its cab, usually near the floor so the operator may better view the work.

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THE large, sturdy acid tanks, lined with rubber, protected with brick, rarely leak. Acid is piped into these from accurately graduated measuring tanks. Lead pipes placed near the tank's bottom are drilled for the introduction of steam that both heats and agitates the pickle bath. Submerged combustion heaters providing violent agitation, necessary for better pickling, are being used. Temperature of the pickle liquor is thermostatically controlled and recorded.

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TANKS are pitched toward large drains through which thousands of gallons of spent pickle liquor may be passed in a few minutes. Large water inlet pipes provide for the rapid filling of cleaned tanks. Steel rinse tanks are provided with an ample overflow of water and in some, high pressure sprays flush loosened scale from the pickled coils.

✦ ✦ ✦

ONE or more steel lime tanks agitated, in some cases with steam and in others with a pump circulator, are placed between the rinse tank and the driers. Temperatures in lime tanks and driers are automatically controlled and recorded.

✦ ✦ ✦

EQUIPMENT such as this not only makes possible the rapid, efficient and economical handling of large tonnages but, with leakproof tanks, a source of waste and mess is eliminated. With controlled temperatures the pickling supervisor has reasonable assurance pickling will be completed in the allotted time in baths — the composition of which he now knows.

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Practice and Supervision

IF the mill executives learned nothing else in the new era, they did realize **that pickling is a chemical process worthy of chemical control.** Most of you have installed a control laboratory in the pickle house, presided over by a chemist or pickling supervisor, whose duty it is to regularly sample pickle baths, titrate them for acid and iron and, based on these titrations, to add acid and inhibitor in the proper amounts and at the proper times. When the optimum amount of iron has accumulated in the bath, preparations are made to discard it.

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THE optimum amount of iron to be tolerated varies. In general, however, when the bath has dissolved approximately one-half pound of iron per gallon (approximately 6%), it is good practice to discontinue the addition of acid and inhibitor, to raise the temperature of the bath to offset the slowing action of its increasing iron and decreasing acid, and to pickle as long as possible to reduce the acid as low as possible before the bath is discarded.

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PICKLE supervisors often do, and always should, keep a running log for each acid tank. A simple and convenient chart for recording all the essential data on the actual pickling is illustrated in the accompanying photograph, reduced to show only four of the seven days in the week.

✦ ✦ ✦

Chart for Pickle Log

BASED on the analysis of bath samples taken at regular times, the acid concentration and iron content in percent are recorded along with the bath temperature at the time samples were taken.

✦ ✦ ✦

TYPICAL graphs for a tank without automatic temperature control are shown by way of illustration. Note the iron uniformly increases, acid and temperature are maintained tolerably constant till the bath has accumulated about 6% iron. At this time acid additions are stopped, the temperature is raised and the acid is consumed in useful pickling till little is left to be discarded.

✦ ✦ ✦

ADDITIONS of acid and inhibitor and the time additions are made should be recorded for each turn. The tons pickled during the turn should also be recorded. Additions of other materials if customarily made to the bath, such as salt, foaming compound, etc., should be recorded for each turn. Total acid, total inhibitor and total tonnage for the week are recorded and from these the acid yield and inhibitor consumption can be calculated.

✦ ✦ ✦

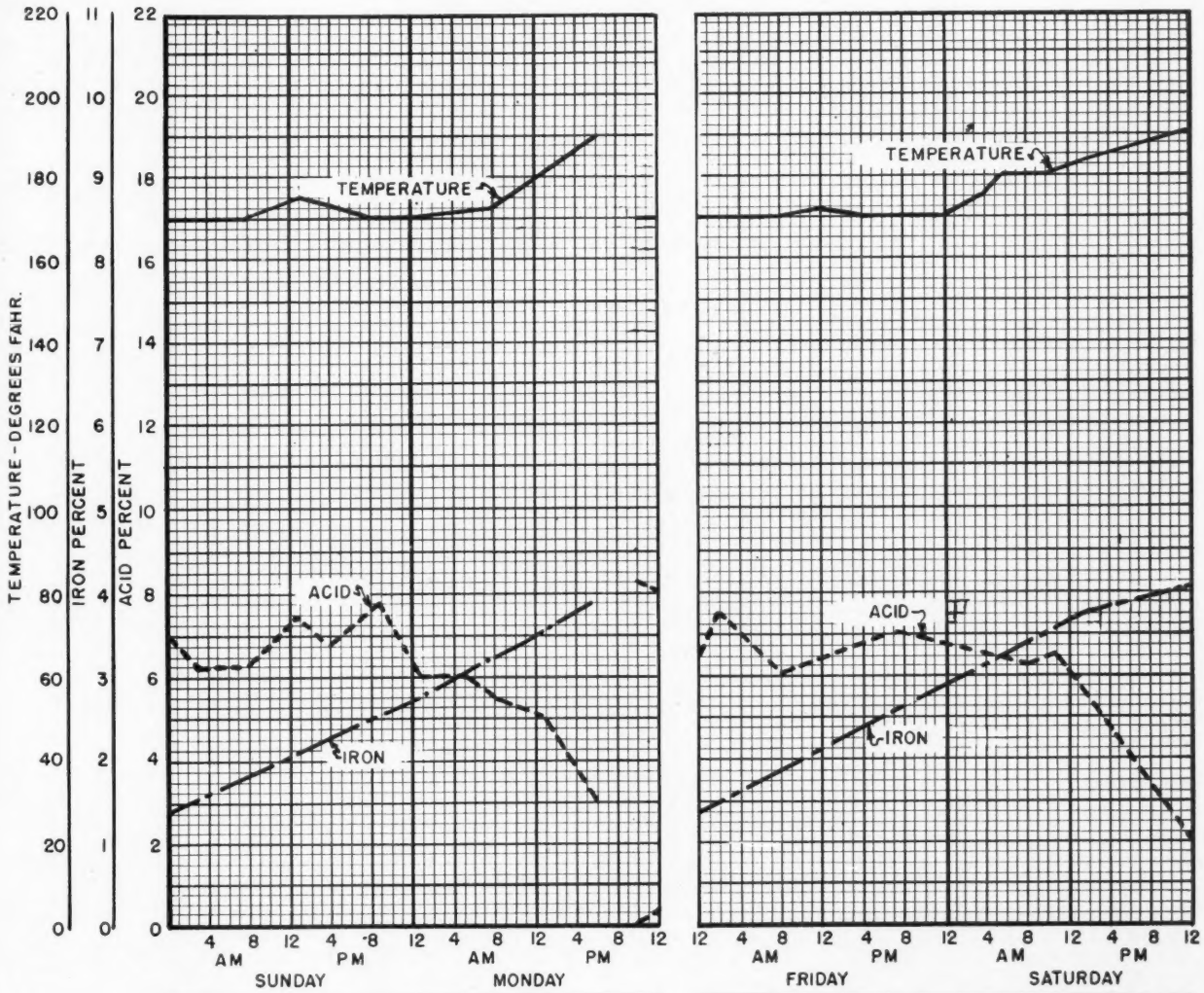
RECORDED data such as this enables executives to readily check pickling conditions, to keep in touch with the department's efficiency and to compare, in production, the effect of any changes in practice they may want to investigate.

WITH intelligent supervision and improved equipment, pickling is no longer a rule-of-thumb wasteful process. **Now, full advantage can be taken of improved inhibitors and their ability to minimize the attack of acid on metal and markedly reduce the absorption of hydrogen with its resultant embrittling action.**

✦ ✦ ✦

STRONG inhibitors are being very generally used in small amounts as the sole addition agent to the sulfuric acid bath. Their unique properties are also being utilized in baths containing both muriatic and sulfuric acid for the pickling of chrome, nickel, vanadium and molybdenum steels, about which more will be said later.

PICKLE LOG FOR WEEK OF_____
DEPARTMENT_____



ACID – LBS.	ACID – LBS.
RODINE LBS / GAL.	RODINE LBS. / GAL.
FOAMER LBS. / GAL.	FOAMER LBS. / GAL.
TONS PICKLED	TONS PICKLED

ACID—LBS.	ACID–LBS.
RODINE LBS. / GAL.	RODINE LBS. / GAL.
FOAMER LBS. / GAL.	FOAMER LBS. / GAL.
TONS PICKLED	TONS PICKLED

TOTAL ACID FOR WEEK – LBS._____
TOTAL TONNAGE PICKLED _____
TOTAL RODINE GAL._____ LBS._____

ACID PER TON–LBS._____
RODINE PER TON GAL._____ LBS._____

Combination of Acids for the Pickling of Alloys and Soft Steel

WHILE there have been no revolutionary changes in the chemistry of acid pickling to remove mill scale, there have been made minor improvements, some of which are worthy of notice. The pickling of alloy steels, for example, has been markedly improved by a single addition of from five to twenty pounds of rock salt to each one hundred gallons of the usual sulfuric acid bath. Muriatic acid (20° Be.) in the amount of from one to four percent by volume would have the same action. Salt is used because it is cheap and usually on hand.

✦ ✦ ✦

THE presence in sulfuric acid of these relatively small amounts of muriatic acid has a marked effect which can be better appreciated by examination of the accompanying photographs of polished flat surfaces of a chrome vanadium steel. Pickling solutions in all cases contained 5% (by volume) 66° Be. sulfuric acid. The baths were all heated to a temperature of 180°F. The pickling time in the baths containing inhibitor was **three hours,** however, the attack in the uninhibited baths was so great that the samples were pickled for only **one hour.** Samples were all cut from adjoining sections of the same piece of tube and similarly polished. Magnifications in Figures 1 to 4 is thirty diameters.

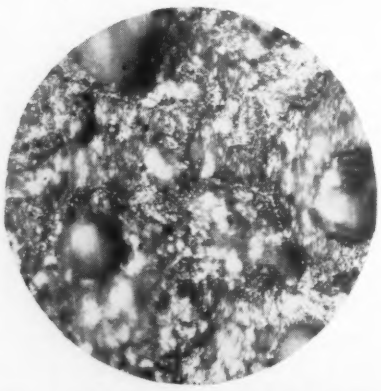


Fig. 1. Uninhibited. Pickling Time One Hour Alloy Steel A-1. 30X. ✦ ✦ ✦

FIGURE 1 is a polished surface pickled one hour in the uninhibited sulfuric acid bath. Note pits are so deep the bottoms are out of focus. No traces of polishing marks or of the original surface are visible.

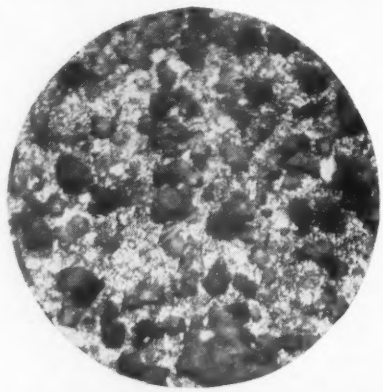


Fig. 2. Uninhibited. Twenty Pounds of NaCl per 100 Gallons. Pickling Time One Hour. Alloy Steel B. 30X. ✦ ✦ ✦

FIGURE 2 is a similarly polished surface pickled one hour in the uninhibited sulfuric acid, to which had been added twenty pounds of salt (NaCl) per hundred gallons of bath. Note the regularity of the pits and how shallow these are compared with those in Figure 1.

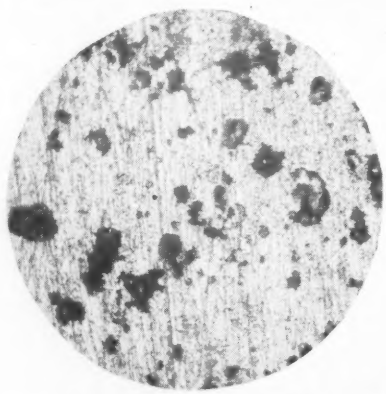


Fig. 3. Inhibited with Rodine #81. Pickling Time Three Hours. Alloy Steel C-1. 30X. ✦

FIGURE 3 is a similarly polished surface, pickled three hours in a bath containing only sulfuric acid, water and Rodine #81 (1% by volume of the sulfuric acid).

✦ ✦ ✦

IN spite of the fact that this surface was pickled three times as long as those shown in Figures 1 and 2, there are fewer and shallower pits. Most of the surface remains unchanged, with the polishing marks still visible.

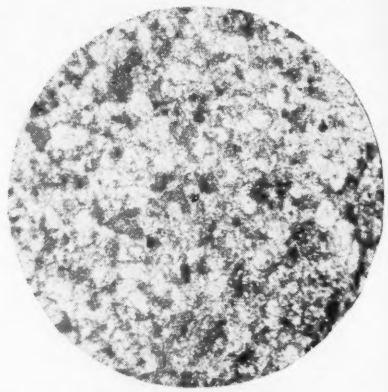


Fig. 4. Inhibited with Rodine #81. Twenty Pounds of NaCl Per Hundred Gallons. Pickling Time Three Hours. Alloy Steel D-1. 30X. ✦

FIGURE 4 is a similarly polished surface, pickled three hours in a bath containing sulfuric acid, water, twenty pounds of salt per hundred gallons and Rodine #81, (1% by volume of the sulfuric acid).

✦ ✦ ✦

THE surface is interesting. It presents a uniform, shiny, crystalline structure with no deep pitting. It would seem such a surface would be an ideal one for drawing, in that ample tooth for lubricant exists and the flattening out of the fine crystals could probably be accomplished with less die pressure and less heating.

✦ ✦ ✦

WHILE a visual inspection of the surfaces obtained is of interest, other features must be considered, for one might suspect the metal loss of the etched sample, illustrated in Figure 4, to be much greater than that of the sample pickled in the inhibited bath (Figure 3), where so much of the original surface is intact.

✦ ✦ ✦

THE metal losses of the four samples illustrated in Figures 1 to 4 are given in Table I. In comparing these, it should be kept in mind that samples illustrated in Figures 1 and 2 were pickled only one hour, while samples illustrated

TABLE I
Metal Loss of Samples of Polished Alloy Steel
Sulfuric Acid 5% by Volume 66° Be. Temperature 180°F.

Pickling Time 1 Hour No Inhibitor		Pickling Time 3 Hours Inhibited with Rodine No. 81	
Sample 1	Sample 2	Sample 3	Sample 4
No Salt Metal Loss 6.55%	Salt Metal Loss 0.41%	No Salt Metal Loss 2.02%	Salt Metal Loss 0.21%

in Figures 3 and 4 were pickled three hours. The low metal loss of Sample 2 should not, therefore, lead to the conclusion that salt, without an inhibitor, may be safely used in pickling such alloys.

✦ ✦ ✦

FROM the photographs and weight losses it is evident the mere addition of salt to a sulfuric acid bath used to pickle chrome vanadium steel for instance, markedly improves the pickling. It is even more noteworthy that if, in addition to salt, a strong inhibitor, designed for use in such baths is also added, over-pickling is substantially prevented. The metal loss and, of course, the acid consumed are minimized and a smooth, fine crystalline surface is obtained. The suitability of such surfaces for improved drawing would no doubt warrant investigation.

✦ ✦ ✦

THE effect of muriatic acid additions to sulfuric acid baths on the pickling of soft steel is different than on alloys.

✦ ✦ ✦

SAMPLES 5, 6, 7 and 8 of unpolished, scale coated hot rolled steel bar stock were, like the previous ones, pickled in a solution containing 5% by volume 66° Be H_2SO_4 at a temperature of 180°F. for one hour. The amount of salt used in pickling Samples 6 and 8 and the amount of Rodine used in pickling Samples 7 and 8 were the same as the amounts used in pickling the corresponding samples of alloy steel shown in the previous figures. Pickled surfaces were magnified thirty diameters in Figures 5 to 8, as in the case of Figures 1 to 4.

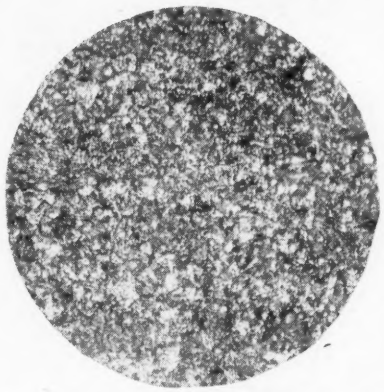


Fig. 5. Uninhibited. No Salt. Mild Steel A-1. 30X. ✦ ✦ ✦ ✦

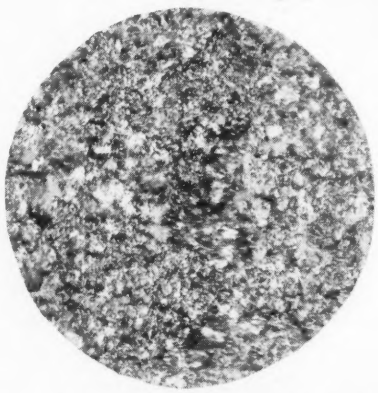


Fig. 6. Uninhibited. Salt. Mild Steel B. 30X.

THE soft steel pickled in the uninhibited sulfuric acid for one hour is uniformly, though deeply etched, as shown in Figure 5.

✦ ✦ ✦

WITH muriatic acid in the bath, more and even deeper pitting occurred than with sulfuric acid alone, as shown in Figure 6.

✦ ✦ ✦

AS is to be expected, the use of Rodine practically eliminated pitting. Note in Figure 7 much of the surface shows no attack.

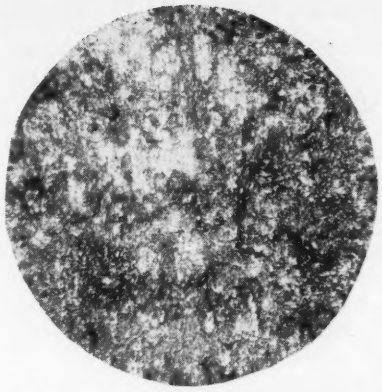


Fig. 7. Inhibited. No Salt. Mild Steel C-1. 30X.

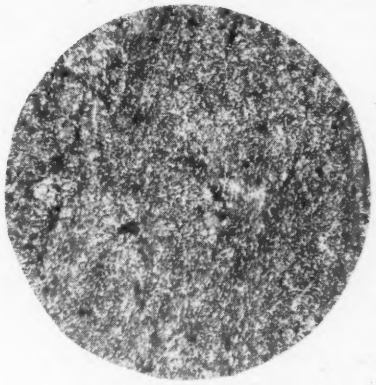


Fig. 8. Inhibited. Salt. Mild Steel D. 30X. ✦

THE uniformly over-pickled appearance and the presence of several deep pits of the sample pickled with Rodine and salt is shown in Figure 8.

✦ ✦ ✦

THESE same samples are shown in Figures 5-A to 8-A, photographed with 150 diameters magnification. While they do not contribute much to the study, they indicate more clearly the effect of Rodine in preserving the original surface. Note the absence of the burned appearance and the small number of pits in Figure 7-A.

✦ ✦ ✦

THESE photographs (Figs. 5-A, 6-A, 7-A and 8-A) indicate more pitting occurs in both inhibited and uninhibited baths when muriatic acid is present in sulfuric acid solutions. The absence of pitting and the preservation of the surface in the inhibited sulfuric acid solution is clearly indicated in Figure 7-A.

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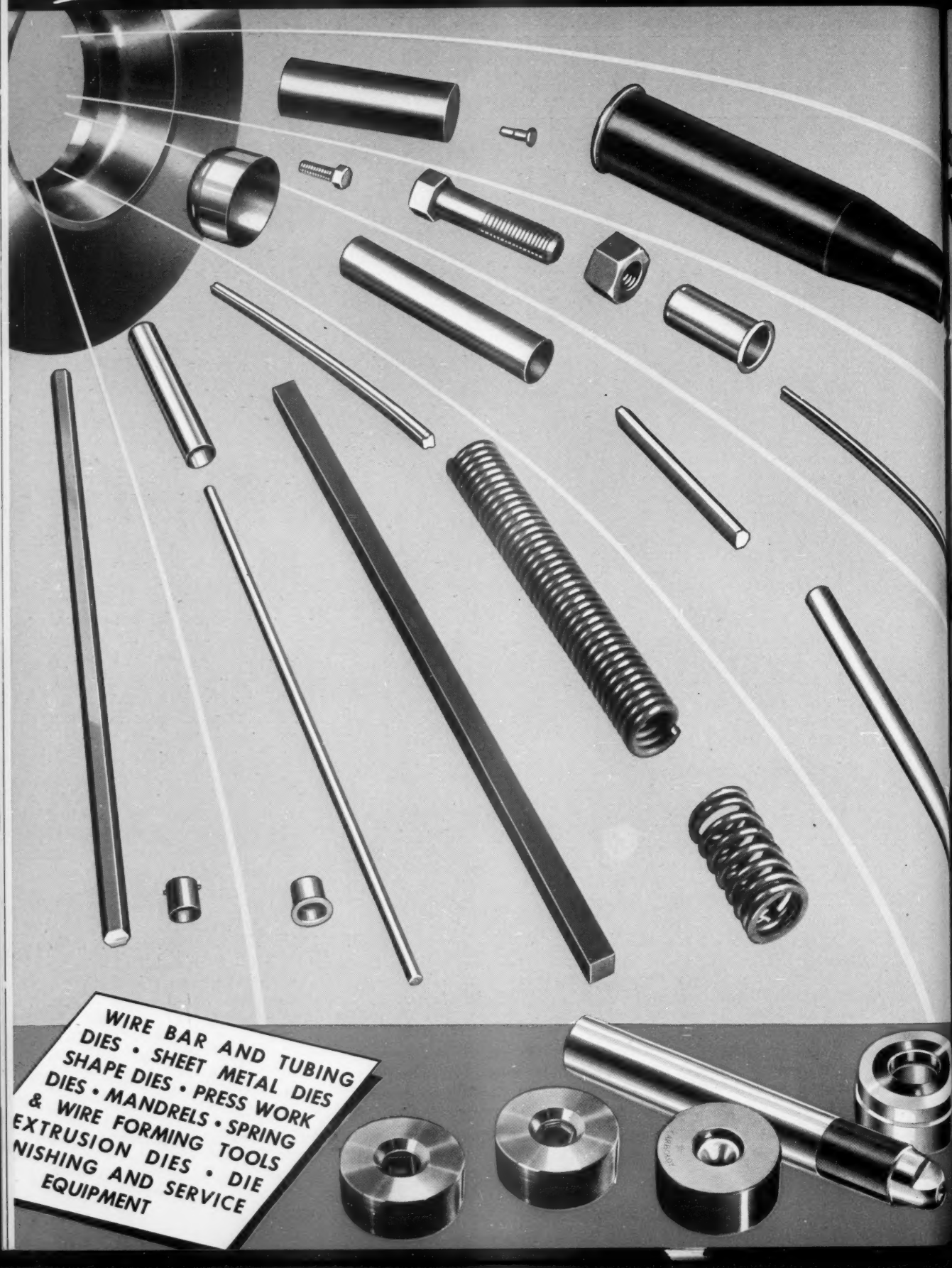

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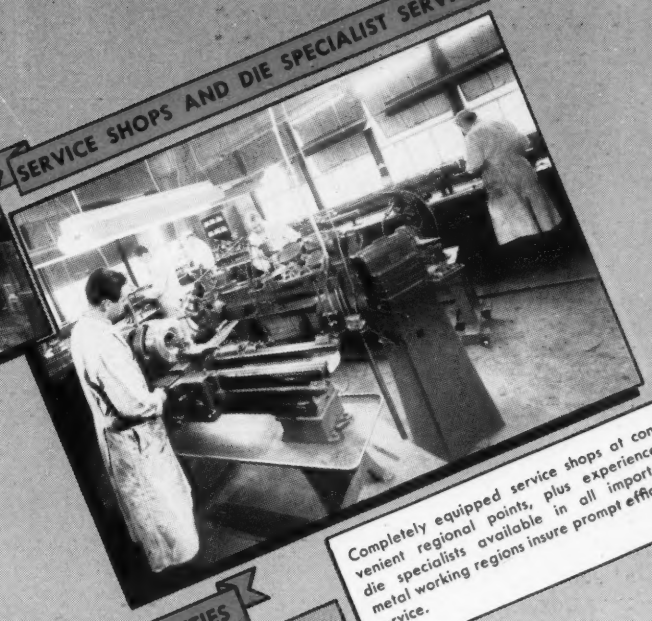

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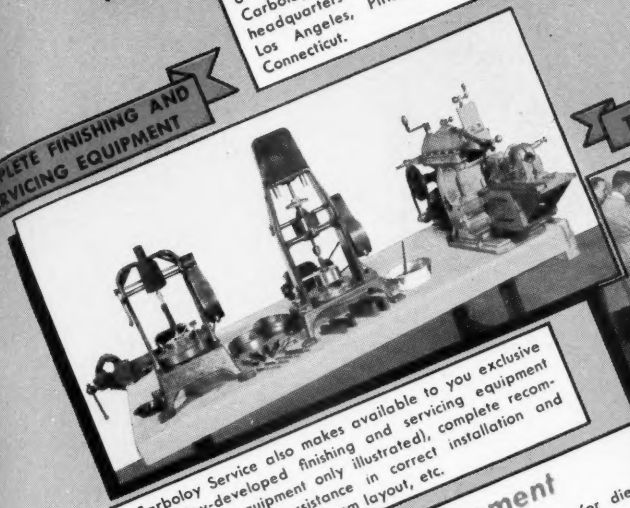

Carboloy Service also makes available to you exclusive Carboloy-developed finishing and servicing equipment (shape die equipment only illustrated), complete recommendations and assistance in correct installation and operation, proper die room layout, etc.

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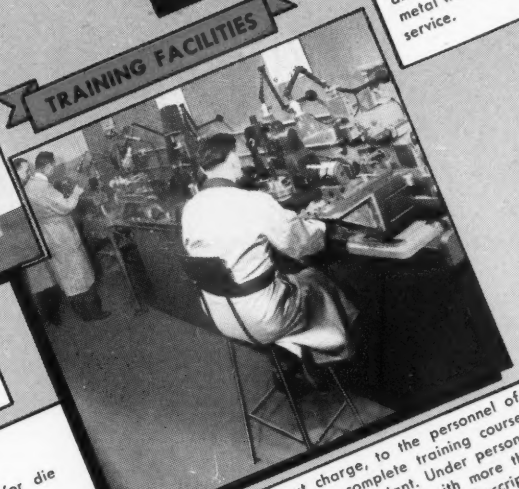

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Typical of the steady progress in Carboloy developments for die users are:

- Grade 999—a special grade for extra long life in the drawing of fine steel wire.
- Grade 958—a special grade providing extra fine finish, extra strength in mandrels for tube drawing.
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THESE conclusions are supported by the loss in weight of the samples as shown in Table II.

TABLE II
Metal Loss of Samples of Hot Rolled Soft Steel
Sulfuric Acid 5% by Volume 66° Be.
Temperature 180°F. — Pickling Time One Hour

No Inhibitor		Rodine No. 81	
Sample 5	Sample 6	Sample 7	Sample 8
No Salt Metal Loss 0.91%	Salt Metal Loss 1.09%	No Salt Metal Loss 0.065%	Salt Metal Loss 0.086%

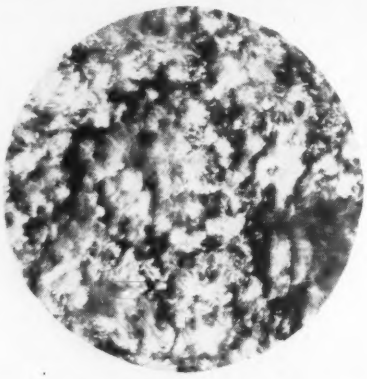

Fig. 5-A. Uninhibited. No Salt. Mild Steel "A". 150X Mag.

FROM the above (Table II) it is evident the metal loss in the inhibited solution is but a fraction of that in the uninhibited bath, also that the presence of muriatic acid is of little help in the pickling of such steels for the attack is, if anything, greater when both the inhibited and the uninhibited baths contain salt.

✦ ✦ ✦

THE use of strong inhibitors has become so much a part of pickling practice in wire as well as other steel mills, that to further enlarge upon their merits is unnecessary. It might, however, be appropriate to note in passing, that the use of strong inhibitors, stable in hot acid baths, has been a factor in reducing the embrittlement of pickled wire to an extent that rapid drying of the limed rods is now accomplished in flash bakers, instead of in the slower tunnel ovens formerly required to expel the occluded hydrogen.

✦ ✦ ✦

Copper Coating and the Treatment of Copper

INHIBITORS play an important role in wire mills in an indirect application. Advantage has been taken of the unique effect of a special inhibitor in the development of a proprietary chemical "Cuprodine", which is being used extensively in wire mills instead of commercial copper sulphate, on rods to facilitate drawing, as well as for coppering rat-trap wire, welding rods, or wire requiring a copper coating for other products.

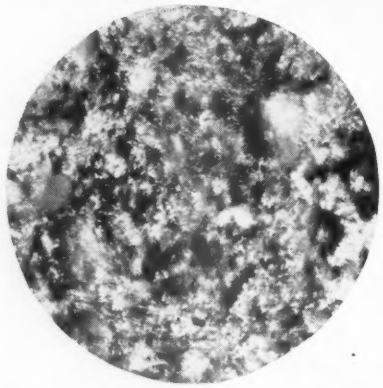

Fig. 6-A. Uninhibited. Salt. Mild Steel "B" 150X.

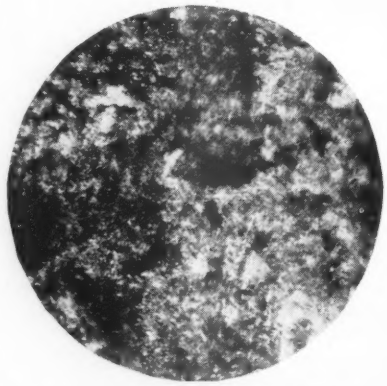

Fig. 7-A. Inhibited. No Salt. Mild Steel "C". 150X.

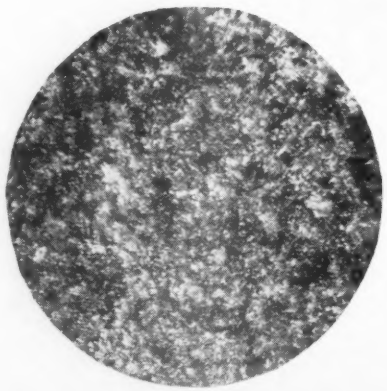

Fig. 8-A. Inhibited. Salt. Mild Steel "D". 150X.

✦ ✦ ✦

THE crystalline chemical **"Cuprodine"** is added to sulfuric acid solutions and used in much the same way as commercial copper sulphate. The coating obtained with **Cuprodine** is tight, bright and adherent. Longer die life, better drawing and better wire are attributed to its use.

✦ ✦ ✦

COPPER coatings being cathodic to steel, stimulate rust on the basis metal and may not therefore be looked upon as even a temporary rust preventive. The wide use of **"Cuprodine"** in many industries has led to the development of another proprietary material **"Cuprotek"**. The application of this to the copper coated surface retards corrosion.

✦ ✦ ✦

WHILE the treatment of copper coated wire with **"Cuprotek"** retards rusting, the treatment should not be viewed as one to which copper coated wire may be subjected to provide a perfect protection for steel.

✦ ✦ ✦

THERE is some reason to believe that copper coated wire "Cuproteked" does not draw quite as well as the freshly coated, non-oxidized surface. However, since corrosion definitely impairs drawing qualities, "Cuprotek" as is, will be helpful and a development, including a lubricant, may further extend the usefulness of this process.

✦ ✦ ✦

THERE may be an interesting application of "Cuprotek" in

the non-ferrous wire mills, particularly for wire cables. Apparently this treatment applied to solid copper, either builds a microscopic film or passivates the surfaces, or does both these, so that less sulphide staining as well as less corrosion occurs.

✦ ✦ ✦

TO illustrate the effect of the "Cuprotek" treatment on solid copper, two short lengths were pickled in muriatic acid, rinsed and dried. One of these, "A" in Figure 9 was treated with "Cuprotek". Sample "B" was not treated. Both were forced into lengths of rubber laboratory tubing that completely and tightly encased the straight sections. The wires were then heated in an oven two hours at 95°C, after which the rubber tubing was removed from part of the straight section to observe the effect.

✦ ✦ ✦

THE un-retouched full size photo — Figure 9 — shows the untreated Sample "B" to be badly stained, while the "Cuproteked" sample is apparently unchanged.

✦ ✦ ✦

FIGURE 10 shows the surface of the treated wire is relatively unattacked. Figure 11, on the other hand, indicates appreciable action has occurred on the untreated sample.

✦ ✦ ✦

General

IN summarizing, it is believed that with the systematic supervised pickling that characterizes today's practice, acid consumption, metal loss, costs and quality are tolerably satisfactory. Improvements are however always sought. It may well be that scale breaking by more rapid cooling of hot rods, or that a chemical treatment of these will be developed that may so modify the nature of the scale that further economies and greater pickling speed will be obtained.

✦ ✦ ✦

ENCOURAGING work is being done along the latter line. Alloy steel forgings are now being treated in the heat treating process with the result that scale is loosened sufficiently to flake off almost completely when the treated forgings cool. More work is required to adapt this process to the treatment of wire rods or to the furnaces in which they are treated.

WETTING agents in the pickle baths are being used, principally in sheet rolling, or where the presence of oil on the surface interferes with the acid's uniform action. Wetting agents of themselves usually have no restraining value. Any savings they provide comes from the better run-off of acid. There are however, pickle bath toners with inhibiting properties which have the effect of wetting agents.

✦ ✦ ✦

TILL suitable means are found to prevent scale formation, some method will have to be used to remove it. Controlled atmosphere furnaces or means of excluding air in heating process are being utilized in industry and are applicable to heat treating operations. These however hold little promise for the prevention of scale on rods.

✦ ✦ ✦

WHETHER scale is removed with acid or otherwise, there is likely to be a continuing need for an acid cleaning to assure the kind of surface needed to hold lubricants for drawing or to bond zinc in galvanizing. Pickling or acid cleaning is likely to continue challenging the ingenuity of the research laboratory and the production man for further improvements and improved pickling practice.

Fig. 9. Solid Copper Wire. "A"—Cuproteked. "B"—Untreated. ✦ ✦ ✦

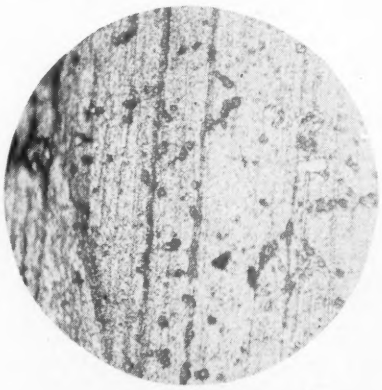

Fig. 10. Surface of Treated Sample "A" of Fig. 9. Copper Wire—Cuproteked. 30X. ✦

Fig. 11. Surface of Untreated Sample "B" of Fig. 9. Copper Wire—Not Cuproteked. 30X. ✦

✦ ✦ ✦ ✦ ✦ ✦

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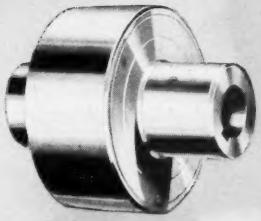

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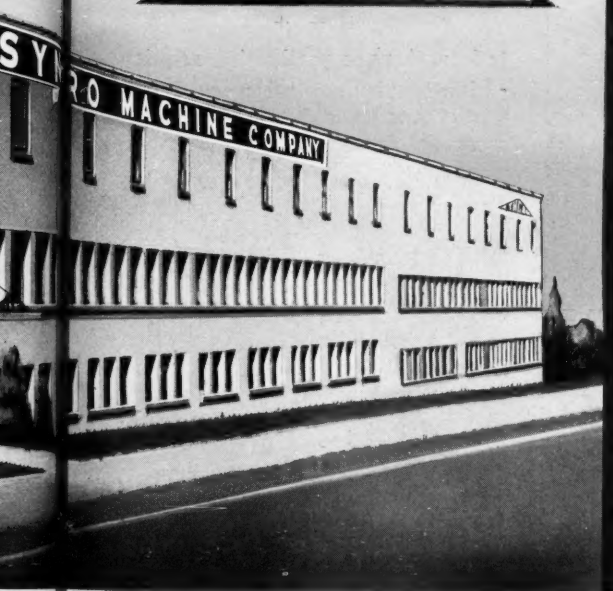
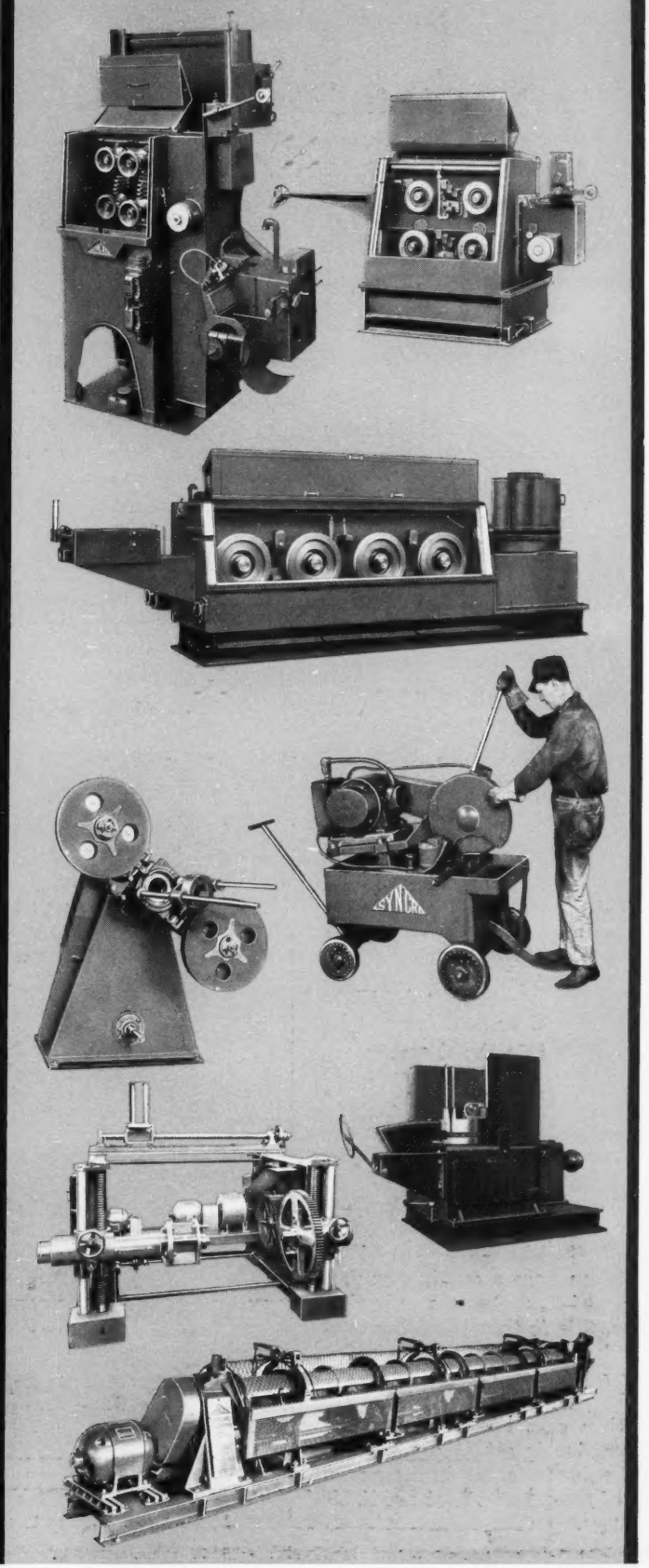




Tension and Velocity Controls; Applications of the Mechanical Variable Speed Transmission

By Joseph H. Gepfert,
Division Manager, Reeves Pulley Company,
Cleveland, Ohio.

Velocity and tension controls have become an extremely important part of daily life in the wire mill. These along with automatic controls are the basis of continuous production systems. This article covers the fundamental approach to the solution of these problems by means of the versatile mechanical variable speed transmission.

IN the changing tempo of production it was assumed that continuous methods would be the solution to the need for more goods, controlled quality and lower prices.

✦ ✦ ✦

MANY continuous processes are made possible because of automatic control, falling into two classifications — tension control and velocity control — so we will look into the fundamentals of the manual and automatic operation of these. The basic concepts applying to solution of these problems then can be used in visualizing the application of equipment to solve the other actual problems met with everyday in production.

✦ ✦ ✦

THE function of the continuous automatic production control is to maintain the manufacturing level at its highest value.

✦ ✦ ✦

A PROCESS or function can be divided into the elements

1—of—what you have
2—of—what you desire
3—a—machine to do the work.

the machine then becomes the element transforming the "what you have" into "what you desire."

✦ ✦ ✦

THE machine functions in a process where a continuous flow of material undergoes physical change, this is to control the variables in the process to a point where a desired final result is obtained. To do this the automatic operating part of the control of the machine is set at a predetermined value to maintain those portions of the process that are liable to change.

THIS control is always based on factors as shown above. On #1, what you have, and on #2, what you desire.

✦ ✦ ✦

THE system used for control can be called integrating, feed back, balancing, compensating or differential regulation.

JOSEPH H. GEPFERT

After several years spent in production plants and with consulting engineers, J. H. Gepfert, entered the field of engineering application of production systems and followed into the field of variable speed transmissions in 1930. Gepfert has advanced to where he is now manager of application engineering at Reeves Pulley Company of Cleveland, Ohio. He is well known in the fields of iron, steel and rubber, having extensive experience in the mills of the country. He is also well known as Chairman of the Board of Past Presidents of the Cleveland Engineering Society and Curriculum Chairman of John Huntington Polytechnic Institute.

✦ ✦ ✦

IT always has three points, those already listed and #3 which is the reaction, resulting in a control circuit and means to readjust the machine to maintain (2) what you desire, regardless of changes in (1) what you have.

✦ ✦ ✦

THE functions that can be controlled, in the field of physical changes are —

Rate of feed
Rate of speed
Tension

✦ ✦ ✦

TWO or more of these may be combined, but each phase must be considered separately. They may be sometimes super-imposed and the combined control secured from a single unit, yet they must be considered separately and allowances made for the independent action of each function.

✦ ✦ ✦

IN continuous production requiring tension control, a pre-determined tension is decided upon and set. The process starts and as it continues that tension should be maintained.

✦ ✦ ✦

THE tension can be varied or readjusted to some new value, but the control being the basic quality in the performance, performs only the function of maintaining the tension. The same practice holds true for speed regulations and feed controls.

✦ ✦ ✦

MOST problems connected with continuous production con-

trol, are problems dealing with some function of speed, and as such, fall within the scope of the mechanical variable speed transmission, shown in figure 1.

✦ ✦ ✦

THE mechanical belt type variable speed transmission covered by this discussion, long has been taken for granted. Like so many other things we take for granted we have not made use of its many and varied properties. We shall make a fundamental restatement of its attributes. Basically it is a design covering separable pulleys positioned accurately by levers, so arranged the belt is continually under proper tension control.

✦ ✦ ✦

THE separable pulleys are two sets of cone faced discs, double spline mounted on parallel shafts. All four discs are movable, laterally, on their shafts by means of two levers, pivoting midway between the shafts, adjusted by a screw, with right and left hand threads. An endless vee-shaped belt of special design connects the two sets of discs. Power is transmitted positively and accurately due to the non-slipping, wedge-like action of the vee-belt.

✦ ✦ ✦

FOR minimum speed, the discs and levers on the constant speed shaft are farthest apart while the vee-belt runs at the smallest diameter in the discs. On the output variable shaft the reverse is true and the belt is at the largest diameter, and so this shaft operates at minimum speed.

✦ ✦ ✦

AS these levers are positioned for mean speed the discs and speed changing levers are equally spaced on both shafts and the vee-belt rides at equal diameters on both sets of discs. Output speed on variable speed shaft is the same as the input speed on constant speed shaft.

✦ ✦ ✦

CONTINUED movement of the levers brings us to the maximum speed position. On constant speed shaft discs and speed changing levers are closest together while the vee-belt runs at the largest diameter of the discs. On the variable speed shaft conditions are reversed and this shaft runs at maximum speed. Either shaft may be connected to the source of power and used as the constant speed (power input) shaft, with the opposite shaft driven at variable speeds.

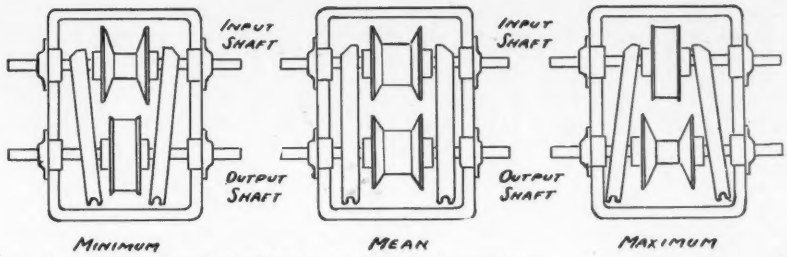


Fig. 1. Arrangement of speed adjustment on variable speed transmission.

✦ ✦ ✦

DRIVING connections may be any type belt and pulley, sprocket and chain pinion and gear, multiple vee-belt and sheaves or direct connected.

✦ ✦ ✦

THE variable speed transmission is placed between the source of power — whatever it may be AC motor, DC motor, shaft, engine, turbine, etc. and the machine to be regulated.

✦ ✦ ✦

THE degree of speed regulation provided by the variable speed transmission is infinite between maximum and minimum speeds. That is any speed to the smallest fraction of a revolution per minute is instantly available and, once secured, may be positively maintained as long as required. The entire speed range is covered smoothly without steps or jumps from one speed to another and this while the driven machine is in operation.

✦ ✦ ✦

THE speed being set by the lever position — is inherently very accurate, for the increments of movement of the lever can be so fine that the speed change would require the most delicate instrument to detect.

✦ ✦ ✦

BEING infinitely positioned, the operation of the discs produce stepless speed range, and operates at a uniform speed under varying load conditions, and as a result the operation is positive and accurate under all conditions.

✦ ✦ ✦

WHEN one shaft is driven at a constant speed, from any source of power, the speed of the opposite shaft, connected to the driven machine, is increased or decreased above and below the speed of the constant shaft as the vee-belt runs over different driving diameters formed by the discs. In this way the output adjustable speeds of the variable speed transmission are established and the ratio between the maximum output speed and the minimum output speed form the range or ratio of speed control. A wide ratio of variation is provided, as high as 16 to 1 if desired. Capacity of such units range from fractional horsepower up to one hundred horsepower.

✦ ✦ ✦

HAVING the operating position of the driving discs positioned by the levers, any medium for positively positioning these levers can be utilized as a speed changing control. In this way automatic controls for continuous production systems is secured.

✦ ✦ ✦

FOR manual control, handwheels, or chain can be used to turn the speed changing screw control-

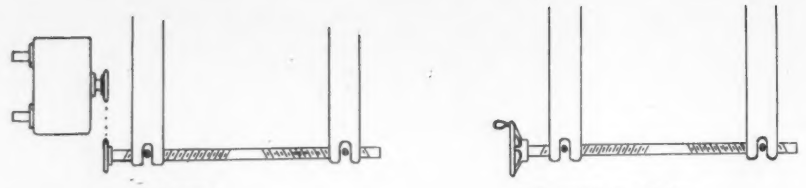


Fig. 2. Arrangement of speed adjustment control.

ling the movement of the levers and discs, as shown in figure 2.

ism. This extended lever can be operated from compensator rolls

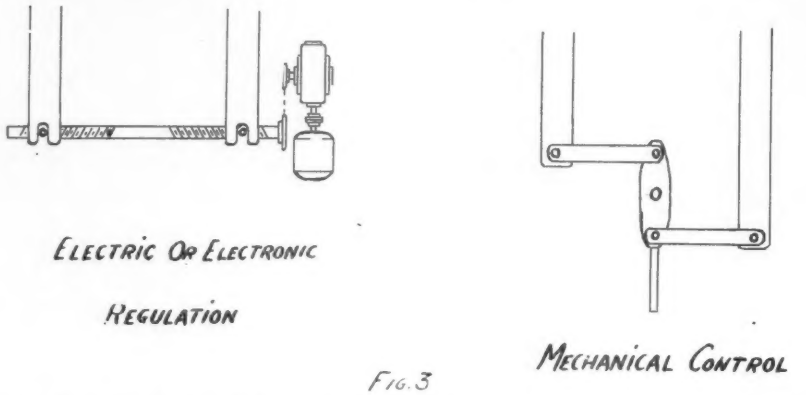


Fig. 3. Arrangement of speed adjustment control.

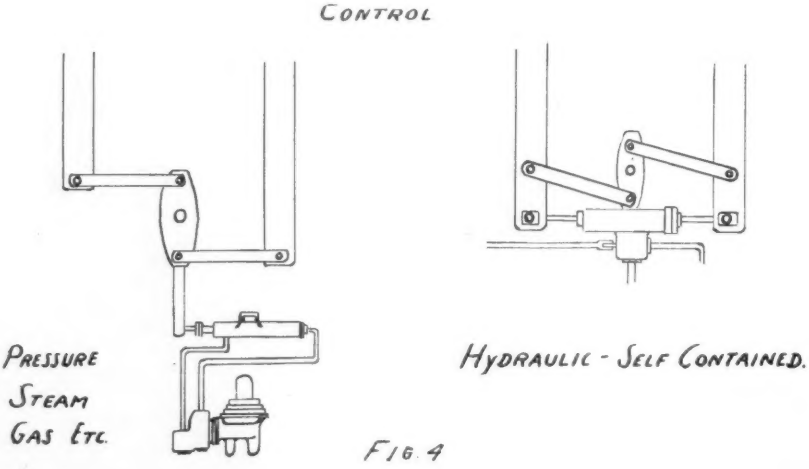


Fig. 4. Arrangement of speed changing control.

FOR continuous automatic operation a speed changing screw can be arranged, controlled in movement by electrical or electronic means; or by differential systems. See figure 3.

✦ ✦ ✦

FOR applications where the controlling force is sufficient to operate the mechanism directly, the screw is replaced by an extended lever and toggle mechan-

as well as hydraulic, pneumatic or steam actuated regulators and control pistons, as shown in figure 3 and 4.

✦ ✦ ✦

FOR applications where the controlling force is slight, it could be as low as five inch ounces — a piston type hydraulic automatic control is used to amplify the control force and at the same time provide a control which does not "hunt" but positions exactly as required regardless of rapidity of change or direction of change. This is shown in figure 4.

✦ ✦ ✦

VARIOUS combinations of the control circuits can be utilized, as example an electronic or photocell control can be applied to a pilotmotor actuated speed changing screw, or the same type pilot motor could be operated from a potentimeter or bridge circuit. Such controls can be direct current or alternating current of any characteristic.

✦ ✦ ✦

EQUIPMENT installed by an Eastern machinery builder in the plant of a large electrical manufacturer is shown in figure 6. This is a triple tandem three stand rolling mill for wire flattening and is an example of the requirements for speed control and tension control in wire mills, showing the ease with which they can be solved using the variable speed transmission.

✦ ✦ ✦

THIS mill takes a large coil of round copper wire and in three passes flattens it to definite closely controlled dimensions both in thickness and width. Many sizes of round wire are handled and, of course, a great many dimensions of flat wire are made.

✦ ✦ ✦

THE first requisite of this mill, if it is to reach high production, is that the speed be set at the greatest possible production rate dependent upon the wire dimensions being worked. To accomplish this a main drive operates the entire equipment and its auxiliary functions.

✦ ✦ ✦

THE coil of wire on the pay-off stand is fed into the machine through a compensating roll which is weighted and counterbalanced to set the original tension. This smoothes out the unequal tension at which the round wire had previously been wound.

THE wire is passed from the tension stand to the first roll stand where the first flattening operation is performed. This first flattening operation is controlled by the main drive which sets the entire speed of the line.

✦ ✦ ✦

THIS line may operate at any preselected speed between 400 feet per minute and 1600 feet per minute. Recently on a high production run, speed of flattening has been checked at an average of 1200 feet per minute. The high speeds on this machine are the result of the close speed control for the entire process, the accuracy with which the tension can be established and the accuracy by which rolling mill stands are synchronized with the wire travel.

✦ ✦ ✦

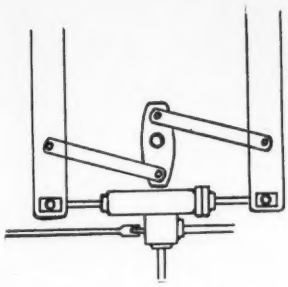
THE wire after receiving its initial flattening in the first mill stand passes through a compensator loop placed between the first and second stand. The travel of this compensator loop sets the speed of the second stand to exactly synchronize the speed of the stand with the speed of the stock and is entirely automatic in operation.

✦ ✦ ✦

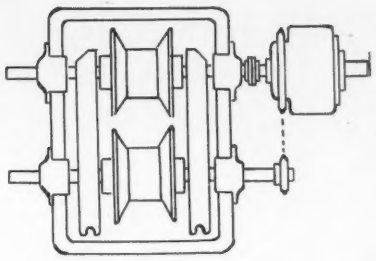
THE wire passes from the second stand to the third stand again under control of a variable speed transmission actuated by a compensator roll, thus setting the speed of this rolling mill stand to exactly synchronize the mill with the speed of the stock. The velocity is maintained in this way with the result that the dimensions of the flattening operation can be held very exactly.

✦ ✦ ✦

THE wire after having been processed in the last stand is now dimensioned as required and is ready to be wound on the merchant spool. The wire passes from the last stand through a compensator roll which operates the variable



Pneumatic-Vacuum
Compressed Air or Gas



Infinite Regulation or Wide Range or
Finite Regulation or Micro Range.

Fig. 5. Arrangement of speed changing control.

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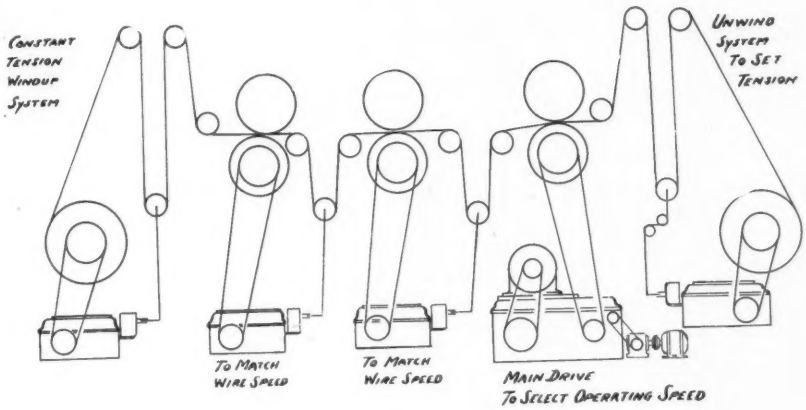

CONSTANT TENSION WINDUP SYSTEM
TO MATCH WIRE SPEED
TO MATCH WIRE SPEED
MAIN DRIVE TO SELECT OPERATING SPEED
UNWIND SYSTEM TO SET TENSION

Fig. 6.

✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

speed transmission driving the wind-up, so that the tension which has been established at the front end of the machine is exactly matched and maintained on the wind-up roll. This is shown in figure 6.

✦ ✦ ✦

IN the manufacture of strip, the control of rolling stand motors is of the utmost importance. The operation of a mill is dependent on the fact that various stands may be controlled in their speed to equal the speed of the previous stand plus the reduction in area and consequent elongation of the material.

✦ ✦ ✦

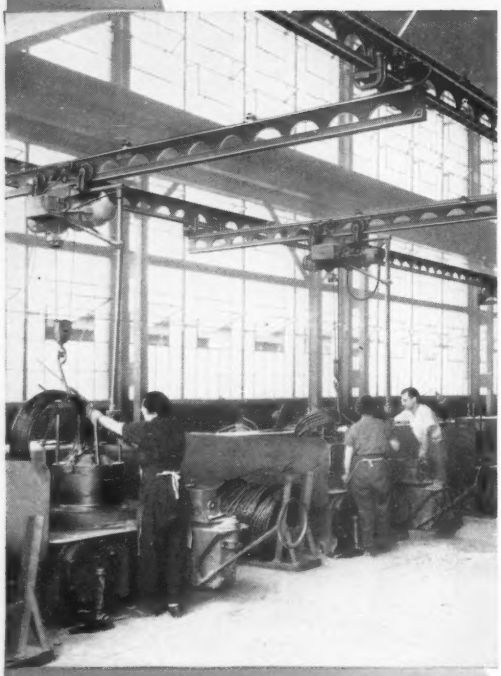
A MILL is satisfactory only in proportion to the accuracy of the speed control. The operation of such a system is an unusually interesting job, both electrically and mechanically.

IN a high speed mill the speeds of finishing operations on ten inch materials may be 3000 feet per minute, and require 500 horsepower driving motors.

✦ ✦ ✦

CONTROL of the speed of one such mill is handled from an operating pulpit through an electric-mechanical differential system. By purshing a control button and changing the relative position of the belt on the disc pulleys of a variable speed transmission, the speed of a driven pilot generator is varied, and the current induced by this generator drives a pilot motor connected to one side of a differential at whatever speed is selected. Another pilot motor operating at a constant speed set up between these produces movement in the differential changing the adjusting member of a vibrating regulator controlling direct current motor field. In this way speed needed is obtained, to exact-

NEW ALLOY STEEL MILL SPEEDS WIRE



Women have invaded the wire drawing room. The hard work of handling heavy coils of rod and stripping blocks is easily done by women. The smooth-operating Cleveland Tramrail Cranes make this possible.

Overhead materials handling equipment is playing a major role in the production of alloy steel wire and rod in one of the latest and most modern mills in the country.

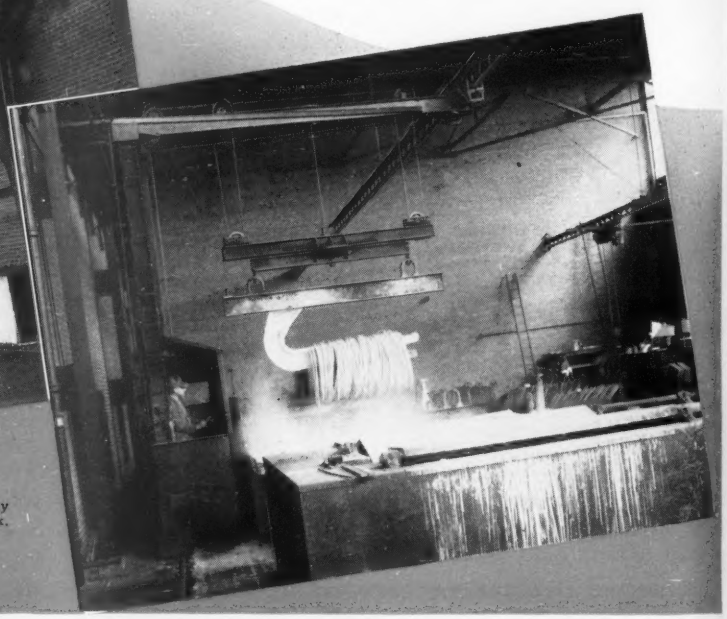
Outstanding in this large, clean plant are the Cleveland Tramrail installations in the Wire Cleaning and Drawing Departments where is produced stainless steel wire ranging in size from .005 inch to 5/16 inch for welding rod, and ½ inch diameter bullet core for 50 calibre ammunition.

The bullet core rod is pickled, washed, lime-dipped and flash-baked on a standard Cleveland Tramrail cleaning house gantry crane as illustrated below. The stainless steel wire is cleaned on the opposite side of the room. A Cleveland Tramrail arch beam track over the tanks with three one-ton electric hoists perform

CLEVELAND

Bullet core rod to be cleaned is picked off the buggy by the cleaning house gantry crane with a hairpin hook.

The rod is then dipped in lime and carried on to the flash baker. It should be observed that all hoisting machinery is in a compartment next to operator's and not up where the corrosive fumes can readily attack it.



AND ROD PRODUCTION WITH OVERHEAD EQUIPMENT

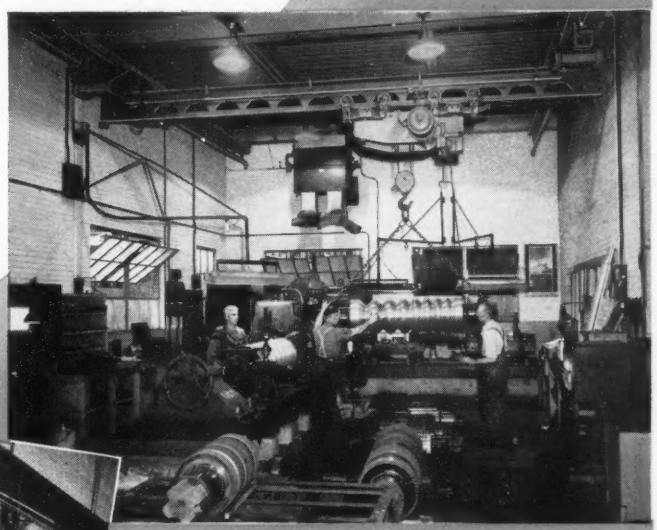
all dipping and moving of the wire. Despite the fumes and splatter of strong acids and caustic solutions, this equipment operates with minimum maintenance.

In the drawing department are eight single and two triple Vaughn Motoblocs that are served by two parallel crane runways on each of which are six cranes. All 12 cranes are of the Cleveland Tramrail block-stripping type. They are hand propelled and have electric hoists on carriers equipped with rigid propelling arms. These smooth running cranes have proven an important factor in maintaining production since they so ease the task that it has made possible the employment of women for this heavy work.

A five-ton Cleveland Tramrail Crane also serves the Roll Shop and thirty-six short-span cranes operating in a heavy metal-dust-ladened atmosphere handle swing grinders.

Whether your plant is large or small Cleveland Tramrail can serve you profitably. With experience in dozens of installations in wire and rod producing and fabricating plants to draw on, our materials handling engineers are in position to capably discuss your methods. Plan now for later—without obligation, of course.

TRAMRAIL



The breakdown rolls are handled in the Roll Shop with this smooth-running 5 ton hand-propelled crane with electric hoist.

The completed rod is easily loaded onto buggies at the end of the line. The ease with which all operations are handled and the cleanliness of the cleaning house should be given particular attention.

BOOKLET No. 2008 . . Packed with valuable information. Profusely illustrated. Write for free copy on your company letterhead.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1141 EAST 283RD ST. WICKLIFFE, OHIO.

ly synchronize the speeds of the roll stand relative to the stock.

✦ ✦ ✦

TO secure an infinite speed range it is necessary to use only a differential gear set, a constant speed unit and a variable speed transmission. Such a unit, which is then capable of infinite speed range, is capable of so high a range solely by virtue of the fact that it is a differential mechanism in combination with a low range variable speed unit. These have applications usually in the control of feeds — as an example a feed screw, such as would be used in machine tool practice. The requirements would be to provide speed control of a feed screw so as to advance one quarter of a thousandth per revolution and be adjustable so as it might be set to advance twenty-thousandth per revolution. This would call for a variable ratio of 80 to 1 from minimum speed setting to the maximun speed setting. For this we could assume a differential of the type having a sun pinion driven from a main drive shaft at a constant input speed; a planetary spur gear assembly driving the feed screw without the necessity of any change gears; and an internal toothed ring gear in contact with the planetary pinions and integral with the housing of the differential, the housing in turn carrying a sprocket and being driven by it, under control of the variable speed transmission.

✦ ✦ ✦

IT will be clear that it is no more trouble to secure a range of infinity, even with some reverse, than it is to secure this range of 80 to 1. The chief difficulty with such a system is high internal stress and low efficiency making them usable only for low horsepower capacity and intermittent service.

✦ ✦ ✦

IN operation, the variable drive at its maximum speed, will cause the housing and ring gear of the differential to be driven at maximum speed which would produce O RPM of the feed screw. When the variable drive would be adjusted to minimum speed, the differential housing would be forced to run at its lowest relative speed, which would cause maximum speed of the output shaft and in turn drive the feed screw at its maximum revolutions per minute. This is shown in figure 5.

✦ ✦ ✦

OCCASIONALLY there arises a requirement for speed control to a very limited degree — perhaps only a few revolutions per minute.

✦ ✦ ✦

THE reverse type differential actuated by the variable speed transmission provides this micrometer range of speed control and is being used for slitters, cutters and feeders.

✦ ✦ ✦

AS an example, such a variable speed drive can be used to provide the speed change required on feeding rolls, after the rolls were reground.

✦ ✦ ✦

THE gear-tooth-splitting characteristics of such a drive, providing even closer speed regulation than could be secured by changing only one tooth in a gear train, would be used to offset the speed difference caused by a few thousandths of an inch diameter difference in the rolls.

✦ ✦ ✦

THE use of the variable speed transmission for this purpose has opened a possible new field for speed setting of rolls, so that the delivery of material can be made equal to their true pitch line.

✦ ✦ ✦

THIS should make possible exact matching of forming mill rolls and do away with much of the time spent in changing pitch lines and contours of rolls, as well as aid setting up of such machines.

✦ ✦ ✦

THE same transmission system can be used for wire feeds for forming, tying and processing machines. It also offers possibilities in setting and matching speeds in drawing operations, and is same as shown in Figure 5.

✦ ✦ ✦

IN Figure 7 is shown the equipment as supplied to provide constant tension control and velocity control in an application where the finished material was to be wound up on a roll.

✦ ✦ ✦

THE difference in this installation being that the material is fed up to this point by another machine while this entire portion of the equipment is driven by a constant speed alternating current motor as a separate source of power.

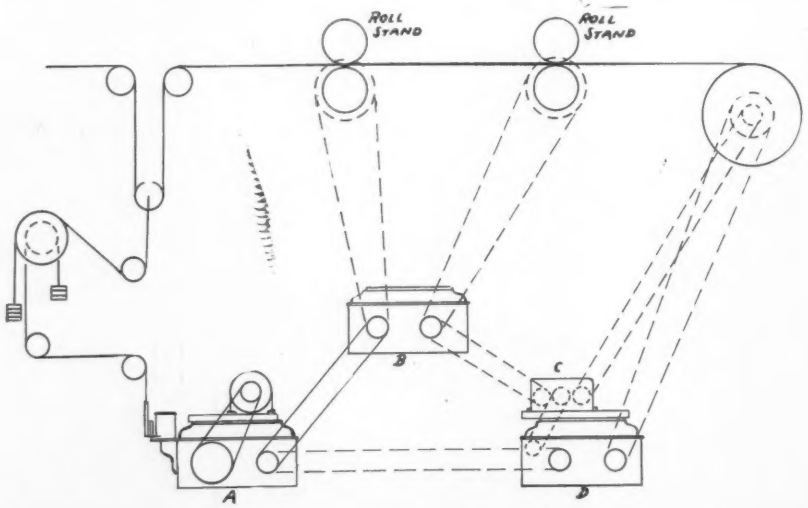


Fig. 7.

THEREFORE the first operation in this equipment is to match the velocity of the stand of material as delivered and place it under tension control. This is done by using a variable speed transmission shown as A, arranged with a piston type hydraulic controller operated from the travel of a floating roll.

✦ ✦ ✦

THE travel of this floating roll is rather short, so a ratio changing arrangement is used between the floating roll and the operating lever of the piston control.

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AS the stock is delivered up to this floating roll it progresses over the first fixed roll of the compensating stand, down under the floating roll forming a loop, running up over the other or fixed roll of the compensating stand.

✦ ✦ ✦

IF the material is fed faster at a given instant the tension would tend to be decreased, but then the floating roll would assume a lower position due to the counterbalance and this tendency would tend to shift and change the speed of the transmission to a point where the tension velocity ratio were reestablished at whatever speed necessary to tension the material as required and to exactly match the rate of delivery with the further feeding of the operations.

✦ ✦ ✦

THE transmission B in this installation is placed between two roll stands so that there may be adjustments between the speeds of the stands as required by a special part of the operation. This unit is manually controlled.

✦ ✦ ✦

THE transmission D is under control of the differential C and driven by the main drive A. In operation the one shaft of this differential is driven in relation to the actual speed of the stock as it is being rotated at a velocity exactly the same as the periphery of the last roll stand. A second shaft of the differential is connected to the wind-up roll which has a bottom diameter of 6″ and a finished diameter of 30″.

✦ ✦ ✦

AS the material would build up on the roll, the tendency to speed up the material and thus drive the differential faster reacts against the fixed input speed of the differential while the intermediate element of the gear differential adjusts the speed of the variable speed transmission D to a point where constant velocity is maintained. The speed of the roll is decreased as the diameter is built up so that the peripheral speed of the material remains at whatever has been preselected.

✦ ✦ ✦

IN almost the same manner, the differential could be used to synchronize the speed of the elements of the roll stand. If one pair of rolls were of different diameter than the other set, or subject to wear, or were subject to change, then by suitable arrangement of control differential C as applied to the speed adjusting element of drive B, the peripheral speed of the rolls could be kept constant.

✦ ✦ ✦

ANOTHER unit, not shown, is a transmission added to drive the wind-up reel shaft for traverse operation. This unit is usually set manually to adjust the traverse lay dependent on wire width, and so provide a smoothly wound package. The wide speed range of the variable speed transmission renders it especially well adapted for this use.

✦ ✦ ✦

THE fundamental application of the equipment shown in this installation can be applied in any wire mill problem where it is desired to have preselected speeds of any range for an entire operation, to operate equipment at a constant tension, to synchronize machine parts and to maintain a tension in the operation.

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THE units used in this machine are the basic variable speed transmission using pilot motor electric regulation for preselecting the desired operating speeds, and using the piston type controller for operation by the compensator rolls.

✦ ✦ ✦

AS an example of an automatic control function, consider the manufacture of continuous printed manifold forms, which are now a part of our daily business life. These forms consist of several parts, often ten, all printed alike, on varied colors of paper and interleaved with carbons. The problem is that of printing the paper so that a number of forms will later collate, or fold together, in exact register. So it is simply a problem of maintaining an exactly constant tension on paper just as it is receiving its printed impressions. If it is pulled away from the printing unit under the same tension as it

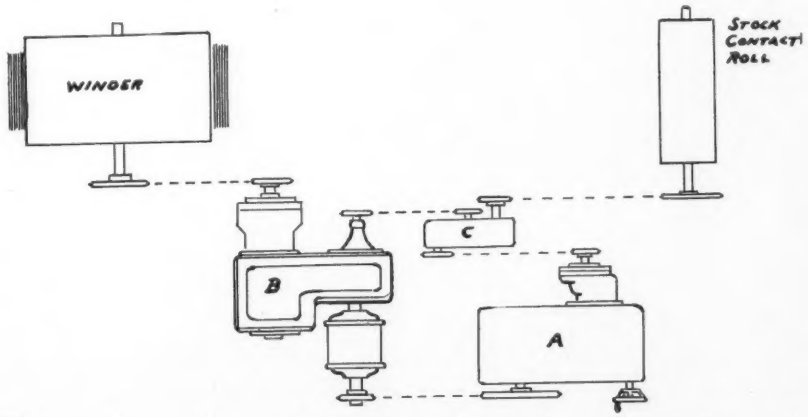

Fig. 8. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

entered the printing unit, there will be exact register of the operations performed between the infeeding and outfeeding points.

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THIS is a common application of tension control, paralleling installations in many other industries. The solution of this problem lies in unwinding the material from a driven roll and feeding it into the machine. By running the material through a compensator roll stand, the tension is established, by connecting the compensator travel to the variable speed transmission which in turn drives the unwinding roll at a rate to properly tension the material. At the end of the processing where the material is to be rewound another compensating stand acts on the material to maintain the pull or tension as established. This functions through connection of the compensating roll travel, regulating the variable speed transmission pulling the material at such a speed as will balance or equal the tension established by the unwinding drive.

✦ ✦ ✦

IN figure 8 is shown the application of equipment such as used in a production job having as its requirement, a roll or coil on which material either wire or strip is to be pulled through a process. The nature of the material is such however, that it may not be flexed around the rolls of a compensator, neither is there a loop such as might be used for photoelectric cells scanning. It is possible though to contact the material with a roller which can be used to indicate the velocity of the material inasmuch as the roller will be actually driven by the material.

✦ ✦ ✦

A FURTHER requirement of this operation is that the speed be adjustable so that it can be preset at any velocity from 50 feet per minute to 300 feet per minute requiring an original speed range of 6 to 1 ratio.

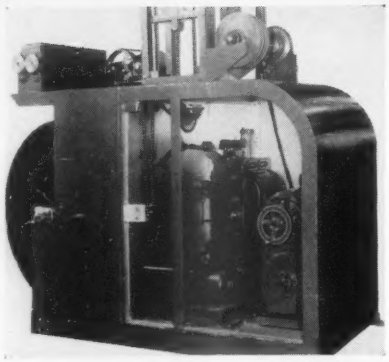

Fig. 9. ✦ ✦ ✦ ✦

WINDING the material on the coil calls for speed control adjustable to a range equalling the relation between the bottom diameter and the finished diameter. In this case that relation was from 8″ to 32″ or requiring a speed range of 4 to 1.

✦ ✦ ✦

THEREFORE to answer the requirements of this installation, it is necessary that the equipment driving the winding spool have a total speed range equal to the lowest speed at the largest diameter and adjustable to the fastest rate of stock travel at the smallest diameter.

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THE operation of this equipment is as follows. An end is placed on the winder which is to pull the stock through processing equipment. The velocity of the stock is to be preset by adjusting the speed of variable speed transmission A, adjusting the output speed to whatever might be desired between the 50 feet per minute and the 300 feet per minute available in the range of the machine. A drive is taken from transmission A to one shaft of the differential C which is being used to check the speed of the stock as indicated by the stock contact roll as a means of establishing the correct speed to be held by the equipment.

✦ ✦ ✦

THE variable speed drive B, driven by a constant speed alternating current squirrel cage motor is the source of power for the entire operation driving the winder as well as presetting transmission A. The speed of the variable speed unit B is changed automatically and continuously by the differential C so that the preset speed is maintained regardless of the diameter to which the stock has built up on the winder.

✦ ✦ ✦

IN operation the stock contact roll drives one shaft of the gear differential; the presetting speed transmission A drives the other side of the differential gear, with the result the third element of the differential compensates and adjusts the speed of the driving element B so that the speed of the winder is automatically and continually reduced to maintain a constant peripheral speed.

✦ ✦ ✦

IF this adjustment of the winder were not exact, there would be a tendency for the stock to speed up, which in turn would tend to rotate the stock contact roll at a faster rate. This tendency to increase in speed is used as the controlling force on the differential so as to provide the automatic regulation of speed necessary in this installation.

✦ ✦ ✦

IN figure 10 there is shown the design of a compensating roll stand, also showing the means of connection to a variable speed transmission. As there are so many applications in industry where a compensator would be used, it is well to consider this as the basis of a design.

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MANY of the applications of automatic speed control are in connection with some material travelling from one machine or operation to another.

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IF the strand is flexible and will not be damaged by contact with idler rollers on both sides, the general method of operating a control remains the same for all applications where it is desired to run the strand from point to point under constant tension. This act-

uating mechanism should consist of a floating or compensating roller in a reverse loop in the strand.

✦ ✦ ✦

IT is immaterial insofar as the success of the control is concerned whether the strand is delivered to this loop or pulled from this loop at the automatically controlled speed. It is assumed that the strand velocity on one or the other side of the loop is constant, or at least determine by conditions outside of the control equipment. We call this side of the loop the constant velocity side, the other being the control side.

✦ ✦ ✦

IF the velocity on the two sides of the loop becomes different, the length of the loop will change, changing the position of the floating rolls. The automatic control mechanism of the variable speed transmission is connected to this floating roll so that the movement of the floating roll operates the speed changing equipment of the transmission and brings the velocity on the controlled side of the loop to again coincide with the velocity on the constant velocity side.

IN the illustration the movement of the compensating roll is connected to a mechanical automatic control. This assumed that the stock being handled would have sufficient tension to provide the force necessary to operate the controlling mechanism.

✦ ✦ ✦

THE compensating roll can be used on very light materials or on low tension. The requirement for such being that a means of increasing the controlling force be added to the variable speed transmission. This can be, as shown elsewhere, the piston type self-contained hydraulic automatic control.

✦ ✦ ✦

IN the illustration the compensating roll R should be light and rotate freely. The weight system A is that which produces the tension on the material. The guide rods, sheaves, rollers, actuating chain are all shown in the sketch. Any weight system can be used to provide the tension. In place of the system shown, this could be a hydraulic or pneumatic cylinder having a definite pressure applied.

NOT only is this system applied in winding and synchronizing operations but it has many uses in its reversed form so that the speed of an unwinding roll can be automatically retarded at such speed that the strand will be delivered at the desired velocity and held under a constant predetermined tension. This does away with and overcomes the exceedingly unsatisfactory performance of brakes on unwinding shafts.

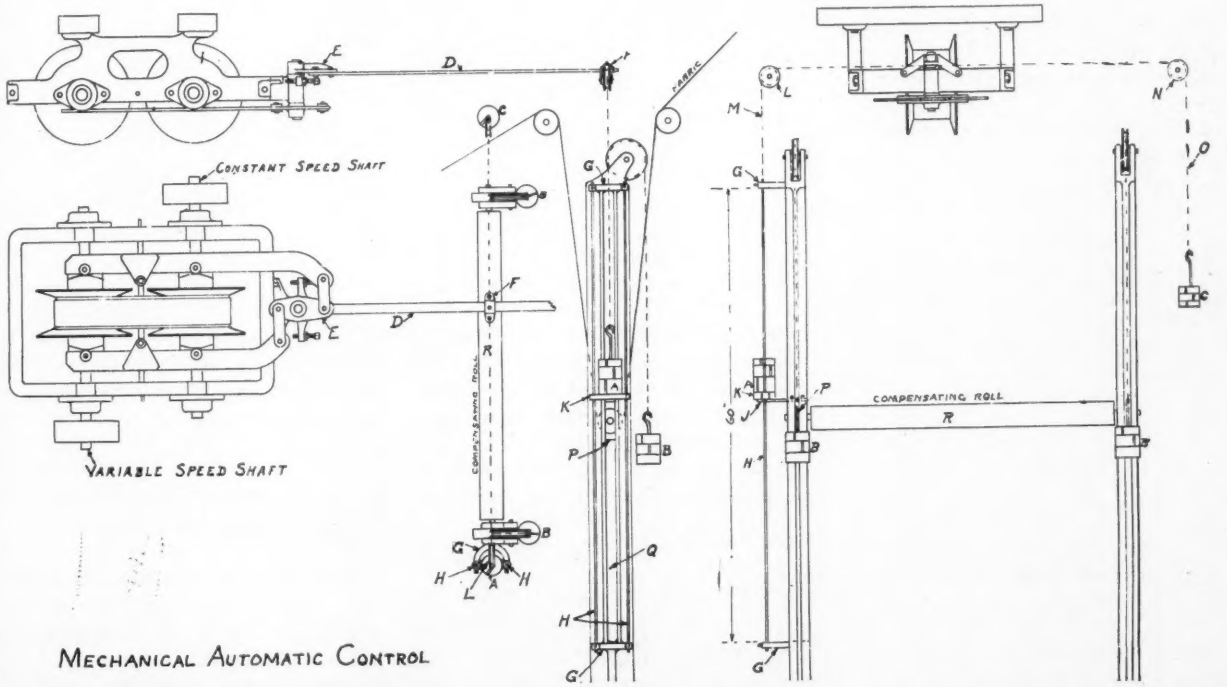
✦ ✦ ✦

A COMBINATION of these units one at the entry end of a machine, and another, reversed at the delivery end of the machine places material under constant tension, controls velocity and so provides the answer to many production problems.

✦ ✦ ✦

THESE units can be made as accessory units. It is not necessary that they are actually built into or are a part of the machine to provide the desired operation. They can be a separate mechanism and applied to existing machines.

(Please turn to Page 729)



MECHANICAL AUTOMATIC CONTROL

Fig. 10. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

Synthetic Insulation and Jacket Compounds

By G. E. ROLSTON,
Chief Engineer, Rome Cable Corporation,
Rome, N. Y.

THE use of synthetic rubber compounds for insulated wire and cable is so new compared to the many years of experience with natural rubber that is is quite difficult to do anything more than summarize in a general way the materials ordinarily used, and outline some of the properties of the finished compounds.

✦ ✦ ✦

AT the time of Pearl Harbor the Rubber Reserve Corporation had built up a stock pile of crude rubber somewhat in excess of 700,000 tons. This amount of rubber would normally be about a year's supply. It was realized that very strict controls would have to be placed on the consumption of crude rubber in order to make it last until the synthetic rubber plants could be built and placed in operation. The Office of the Rubber Director had complete control of the allocation of the crude rubber and by means of restrictive orders to various industries they were able to reduce the consumption of crude rubber very greatly.

✦ ✦ ✦

THE Wire and Cable Industry is the second largest consumer of rubber, but its requirements are still only about one-tenth of the requirements of the tire industry. When the Baruch Committee presented its report with recommendations for the construction of synthetic rubber plants, its greatest concern was to provide in large quantities a synthetic rubber which would be satisfactory for the manufacture of tires. The need for production of these materials was so great that time would not permit the development of special synthetic rubbers which might be more satisfactory for other types of work.

✦ ✦ ✦

Definition of Types Discussed

BEFORE attempting to discuss in detail some of the various synthetic insulating compounds it is important that we clearly understand the types of products that are being discussed. The term "synthetic rubber" has been loosely used to describe any synthetic material having rubber-like properties. This practice has resulted in considerable confusion and the joint problems of the purchaser and manufacturer of wires and cables can be more easily solved if all interested parties will try to differentiate between the various synthetic materials.

✦ ✦ ✦

THERE are two basic types of synthetic compounds being used by the Wire and Cable Industry in the manufacture of insulating and jacket compounds. These are (a) synthetic thermoplastic resin compounds, and (b) synthetic thermosetting materials. The basic difference between these two classes of materials is the fact that the thermoplastic compounds are not vulcanized whereas the thermosetting compounds are compounded and vulcanized in practically the same manner as crude rubber.

THE AUTHOR

G. E. ROLSTON

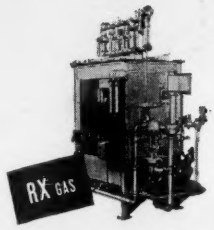
The author served as Power Plant Engineer for the United Gas Improvement Company from 1922 to 1929. From 1929 to 1936 he served as Cable Engineer for the General Cable Corporation. From 1936 to the present time he has been Chief Engineer of the Rome Cable Corporation.

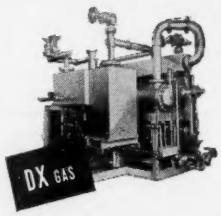
THE Wire and Cable Industry had a limited amount of experience with synthetic insulating materials before the war. Neoprene, Thiokol, Koroseal and Vinylite had been available for several years and because of certain desirable properties of these materials they had been used for special applications. Because of the greater degree of familiarity with the thermoplastic resin compounds, it seems advisable to discuss these products first.

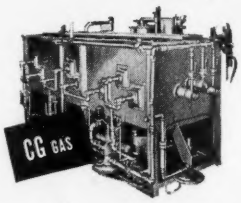
✦ ✦ ✦

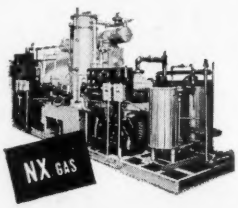
I. Thermoplastic Resin Compounds

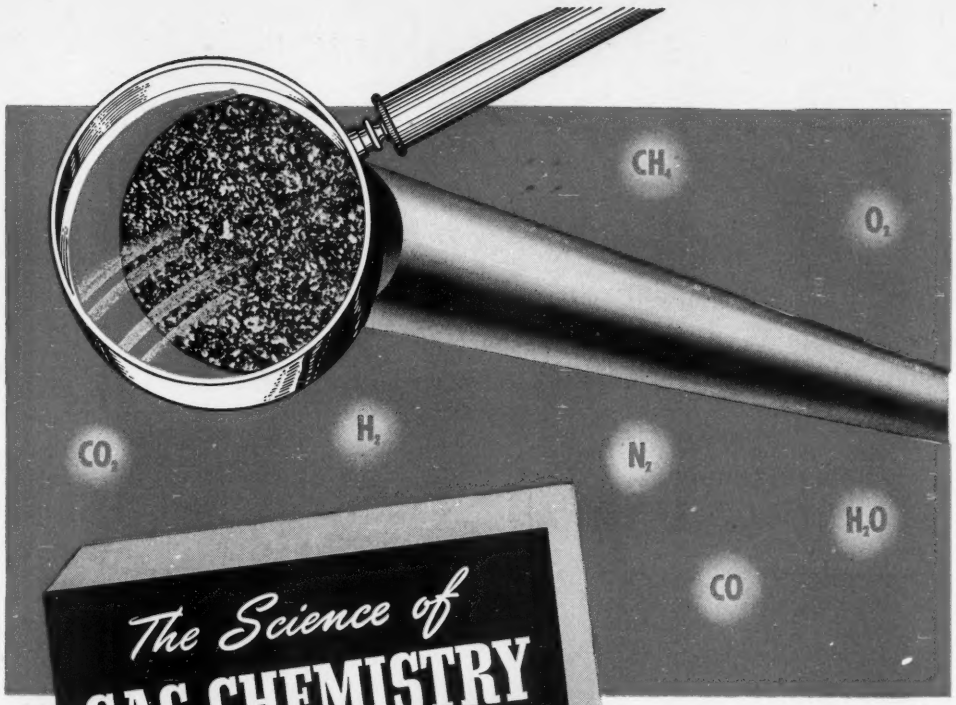
THE two best known thermoplastic resin compounds are Geon (formerly known as Koroseal) and Vinylite. Geon is produced by the B. F. Goodrich Co., and Vinylite is produced by the Union Carbide and Carbon Corp. No attempt will be made to go into the chemical structure of these two materials except to state that they are classed as polyvinyl resins. Koroseal was introduced as a wire covering in 1935, for use on shipboard cable. Both of these classes of thermoplastic resins are supplied in different combinations to obtain certain physical characteristics. The insulating compounds have high dielectric strength and fair insulation resistance, but the dielectric constant and power factor are high compared to high-grade rubber insulating compounds. These types of insulations are generally used for service at voltage ratings of 600 volts or less, but some experience has been obtained on series lighting circuits up to 5000 volts. They are not recommended for use on high voltage











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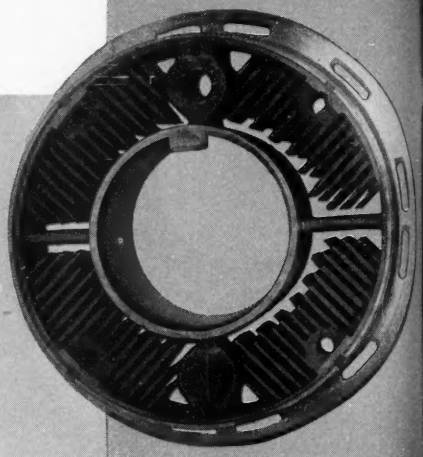
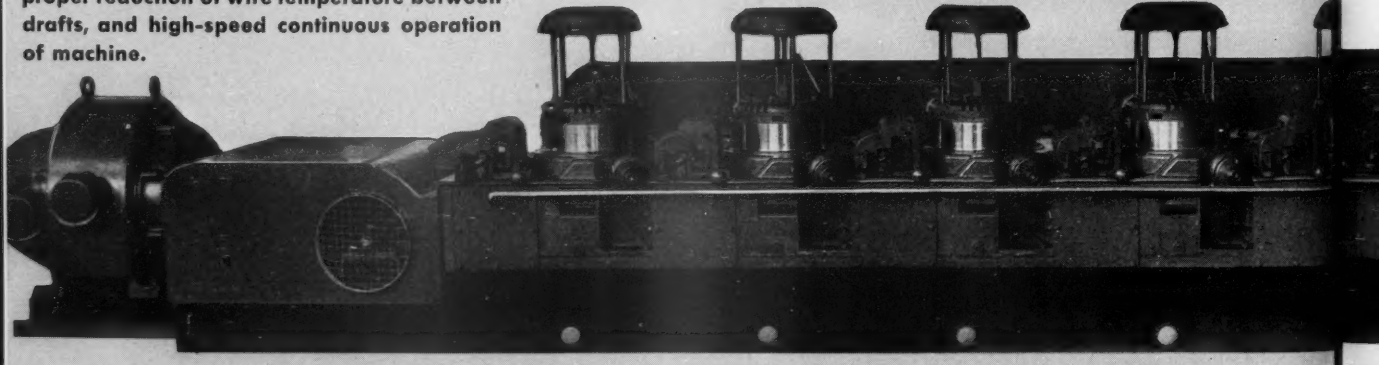


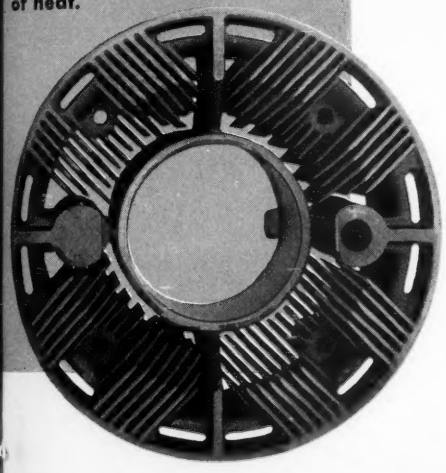
Morgan-Connor High Block Design with patented Fin-type Air Cooled Blocks insures proper reduction of wire temperature between drafts, and high-speed continuous operation of machine.



Type BN Morgan-Connor Wire Machine for continuous drawing of high carbon or low carbon wire. Machine designed for 4, 5 and 6 drafts — interchangeable finishing blocks — high block air cooled design — fully adjustable die boxes for casting wire — draw from welded bundles.

Air Cooling...

Morgan (patented) Fin-type Air Cooled Block presents a large radiating area to insure the fast dissipation of heat.



Air Cooled

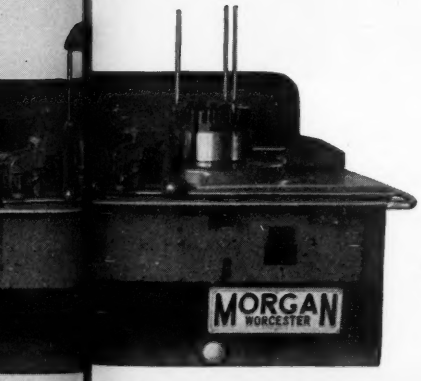
MORGAN-CONNOR WIRE MACHINES

are establishing records

in production of quality high

carbon products at high speed.

W-102



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WIRE DRAWING MACHINERY

MORGAN CONSTRUCTION CO. • WORCESTER, MASS

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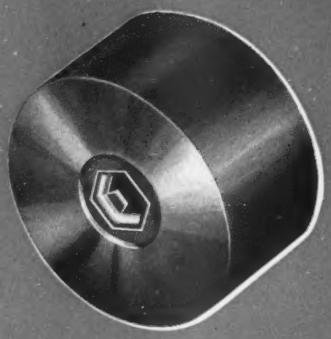

SPECIAL SHAPES

IN TUNGSTEN-CARBIDE DIES

Special Shapes--Special Service!

No need to worry about facilities for fast and reliable production of special-shaped dies—that's the specialty of the Hartley Wire Die Company.

Skilled workmen combined with extreme manufacturing care and most critical inspection assure you dies of the high quality you require, and the prompt service you desire.

"From blueprint to finished product" — that's Hartley service. Just send us the prints of the dies you require; no problem is too tough, no job too large or small. Every assistance we can give is yours.

EYELET DIES
BOLT HEAD DIES
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SPECIAL WEAR RESISTANT DIES
EXTRUSION DIES
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WATCH FOR THE HEART ON *Every* DIE

your assurance of highest quality and service.

L E Y

HARTLEY WIRE DIE CO.

Established 1830

MANUFACTURERS OF TUNGSTEN CARBIDE WIRE, TUBE, EYELET AND SPECIAL DIES, MANDRELS AND PUNCHES.

Thomaston, Conn.

power circuits because of the relatively high losses. The jacket compounds are tough and resistant to abrasion and impact. Because of the fact that they resist oil, acids and alkalies, they have been used as an outer covering on portable cords and cables in many special applications.

✦ ✦ ✦

THE most common use of these resins has been on Type SN building wire, and many millions of feet have been installed during the past five years. The 1940 National Electrical Code limits the use of Type SN wire to sizes #4/0 Awg and smaller, but considerable quantities in sizes as large as 2,000,000 c.m. have been installed. It is planned to issue a 1945 National Electrical Code and field examinations are being made of installations where the large sizes have been used. If this survey indicates that the operating record of these cables has proven satisfactory, the range of approved sizes will be increased to 2,000,000 c.m. in the new Code.

✦ ✦ ✦

A MORE recent development in this class of insulation has been the moisture resistant type of SN wire which is called Type SNW. Samples of wire with thermoplastic insulation of the low moisture absorption grade were immersed in water at 50° C for periods in excess of six months. Electrical measurements were made at frequent intervals and changes in capacitance and power factor were recorded. The results of these tests indicated that properly processed thermoplastic resins were satisfactory for use in wet locations, consequently the Underwriters' Laboratories has issued approval to several manufacturers for Type SNW wire. Special provisions to identify this wire are required. The most common method is to apply a continuous colored stripe on the surface of the insulation, but a printed marking may also be used if a suitable permanent ink is used.

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DURING the past year several of the manufacturers have introduced a full line of flexible cords made with thermoplastic insulation and jacket. At the present time these cords are not recognized by the Underwriters' Laboratories, consequently they do not bear a label. A complete specification has been prepared and samples will be submitted for a complete set of performance tests. If the results of these tests are satisfactory it is assumed that approval will be granted. These particular cords will find many applications in industrial and chemical plants because of their resistance to oil, acids, alkalies and many solvents.

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THERE is a third class of thermoplastic resin compound which has unusually good electrical properties. The dielectric constant and power factor compare favorably with the very best grade of rubber compounds. This material is known as polyethylene. At the present time this material is used exclusively for certain types of combat wire and for coaxial cable on radar equipment. As soon as greater quantities of this material are available it will undoubtedly find many uses on civilian wire products.

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THERE is little question that further development work on the thermoplastic compounds will bring improvements and it is expected that they will play an increasingly more important part in the wire and cable field.

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II. Thermosetting Compounds

THE thermosetting compounds are used in much greater volume by the wire and cable industry and they involve a much more difficult problem of compounding because it is necessary for each manufacturer to select the proper compounding materials which will work satisfactorily with his equipment and at the same time provide a finished product which gives satisfactory performance in service. There are two synthetic thermosetting compounds which are most commonly used by the Wire and Cable Industry. They are Neoprene and Buna-S.

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III. Neoprene

NEOPRENE was introduced commercially in 1932 by the E. I. Dupont Company, under the name of Duprene. This material is frequently referred to as Chloroprene in various specifications. Neoprene has very poor electrical characteristics and is rarely used as an insulation. When properly compounded and cured it is excellent material for sheath or jacket. It is mixed and vulcanized in the same type of equipment as rubber, but minor variations in technique are required. Neoprene, being a thermosetting material, behaves quite similarly to a rubber compound and does not soften at elevated temperatures up to the decomposition point, which is in the neighborhood of 175° C. A general comparison of Neoprene sheath compounds with the best rubber compounds is given below:

(1) **Neoprene has better aging characteristics at room temperature and considerably better aging characteristics at maximum permissible operating temperatures.**

(2) **Neoprene is flame-resistant to a considerable degree.**

(3) **Neoprene is far superior to rubber in oil and solvent resistance and is slightly better than rubber in resistance to acids and alkalies.**

(4) **Neoprene is much more resistant to sunlight than the best rubber compounds. Samples exposed to sunlight for several years show no evidence of light checking. It is also ozone resistant.**

(5) **Neoprene itself is not affected by long exposure to severe wet conditions but it is not as effective as a moisture seal as the best rubber compounds.**

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NEOPRENE has been used for approximately ten years as a jacket or sheath on portable cords and cables and the experience with this material has indicated that it is superior to rubber for this class of service.

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IV. Buna-S or GRS

BUNA-S is a copolymer of butadiene and styrene. This syn-

thetic is produced in tremendous quantities in the new government synthetic rubber plants. The estimated annual production of this material is 800,000 tons, and it is this synthetic that we rely on to make the major replacement of crude rubber.

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IN view of the fact that the tire industry is by far the greatest consumer of Buna-S, the original polymer was selected for this type of work. Unfortunately the wire and cable industry cannot use the Buna-S unless it is carefully processed with a view of the electrical requirements. A special committee of the wire industry prepared controlled compounds using the Buna-S from the various plants. These compounds were carefully tested and it was found that the Buna-S produced at the Naugatuck, Connecticut plant was superior to that produced at other plants when used in insulating compounds. This investigation disclosed that the Buna-S produced at Lake Charles, Louisiana was quite satisfactory when used in jacket compounds. As a result of this investigation all of the wire companies obtain their Buna-S from these two sources.

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THE processing of Buna-S has brought many problems and the necessity for very close process control is much greater than with rubber. The individual batches of Buna-S vary somewhat even though they come from the same plant and this makes separate batch control practically a necessity. The most common practice is to mix the standard sample, the batch is then released to the production department for further processing.

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THE art of mixing, extrusion, etc., of Buna-S compounds has made considerable progress in the past year, but there still is a great amount of work to be done. In general, the Buna compounds do not produce physical and electrical properties that are as good as the comparable rubber compounds. A comparison of Buna-S and rubber compounds is shown in Tables I, II, and III. It should be remembered that these results are based on general averages in one or two plants and are not to be considered as values that are obtainable under all conditions.

TABLE I
Heat Resistant Types of Compounds

	35% Buna-S Rubber	35% Natural Rubber
Tensile Strength	1000	1800
Elongation, inches	2 — 12″	2 — 10.5″
Resistance to Moisture	Good	Good
Cold	Very Good	Very Good
Flame	Poor	Poor
Ozone	Poor	Poor
Light	Fair	Fair
Dielectric Strength, volts per mil	300 — 350	350 — 400
Insulation Resistance K — 1000 ft.	7000	23000
Dielectric Constant	5.0	4.5
Power Factor	3.0	2.0

TABLE II
Oil-Base Ozone Resistant Types
Buna-S versus Natural Rubber

	Buna-S	Rubber
Tensile Strength	525	525
Elongation, inches	2 — 8	2 — 8
Resistance to Cold	Fair	Fair
Heat	Excellent	Excellent
Ozone	Excellent	Excellent
Oil	Fair	Fair
Sunlight	Good	Good
Flame	Poor	Poor
Moisture	Excellent	Excellent
Dielectric Strength, volts per mil	400 — 500	400 — 500
Insulation Resistance Constant (1000 ft., 60°F)	14000	15000
Dielectric Constant (60 cycle, 50 volts/mil)	4.0	4.2
Power Factor, Per Cent (60 cycle, 80 volts/mil)	3.0	3.0

Above data supplied by C. A. Finkel, The Okonite Company

TABLE III
Jacket Compounds
Synthetic versus Natural Rubber

	Neoprene GR-M	Thiokol FA	Hycar OR-15	Koroseal	GR-S	Natural Rubber
Tensile Strength, p.s.i.	2550	1500	2400	2900	2350	4150
Elongation, inches	2 to 10	2 to 6	2 to 10	2 to 5.5	2 to 10	2 to 13
Resistance to Heat	Good	Fair	Good	Good	Good	Fair
Oil	Good	Excellent	Excellent	Excellent	Poor	Poor
Sunlight	Excellent	Excellent	Fair	Excellent	Fair	Fair
Flame	Good	Poor	Poor	Excellent	Poor	Poor
Moisture	Good	Excellent	Good	Good	Good	Good
Cold	Good	Fair	Good	Good	Good	Excellent
Abrasion	Good	Fair	Good	Good	Good	Good
Impact	Good	Fair	Good	Good	Good	Good
Tear	Fair	Poor	Good	Excellent	Good	Good
Deformation	Excellent	Good	Excellent	Good	Excellent	Excellent

Data above supplied by C. A. Finkel, The Okonite Company

V. Comparative Properties of Synthetic Materials

A CHART which appears as Table IV has been prepared which gives a comparison of the properties of a number of synthetic materials. This chart includes both the thermosetting and thermoplastic compounds. Some of the materials shown are not readily available on wire and cable at this time, but they may become available as soon as restrictive controls are removed.

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VI. Butyl Rubber

UP to the present time the Wire Industry has been allocated so little Butyl rubber that no great amount of experience in compounding has been obtained.

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VII. Buna-N

EXPERIMENTAL work on Buna-N has been limited to experimental runs, but information accumulated to date indicates that the possibilities of using this material for special applications is very good.

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Summary

IT is believed that improvements in the Buna-S can be expected, and that increased knowledge and experience in its processing will result in greatly improved properties of the finished compound. Members of a technical committee of the Wire Industry have recently completed the preparation of a specification for Buna-S in the crude form. This specification has been submitted to the two plants that are making Buna-S for the Wire Industry and they are trying to produce a more uniform product in conformance with this specification.

TABLE IV

Synthetic Materials With Promising Characteristics as Alternatives to Rubber for Wires and Cables

Name	Chemical Type	Remarks	Type of Use	Dielectric Prop.	Chem. Prop.	Resis. to Ozone & Sunlight	Physical Prop.	Non-flammability	Oil Resis
Koroseal	Plasticized Vinyl chloride Polymer	Thermoplastic. Extrudable. Several types.	Insulation or Jacket	F	E	E	G	E	E
Vinylite	Plasticized Vinyl chloride-Vinyl acetate Copolymer	Ditto.	Insulation or Jacket	F	E	E	G	E	E
Neoprene	Chloroprene Polymer	Vulcanizable. Rubber-like. Extrudable or calendered strips. Several types.	Jacket	P	E	E	G	E	G
Buna S	Butadiene-Styrene Copolymer	Vulcanizable. Rubber-like. Extrudable.	Insulation or Jacket	G	G	F	G	P	F
Butyl Rubber	Isobutylene-Diolefin Copolymer	Ditto.	Insulation	G	E	G	G	P	P
Hyear OS-10	Butadiene-Styrene Copolymer	Vulcanizable. Rubber-like. Extrudable. Higher styrene content than Buna S.	Insulation or Jacket	G	G	F	G	P	F
Hyear OR-15 and OR-25	Butadiene-Acrylonitrile Copolymer	Vulcanizable. Rubber-like. Extrudable. or calendered strips.	Jacket	P	G	P	G	P	G
Perbunan	Ditto	Ditto.	Jacket	P	G	P	G	P	G
Chemigum III	Ditto	Ditto.	Jacket	P	G	P	G	P	G
Thickol	Organic Polysulfides	Both thermoplastic and vulcanizable types. Extrudable.	Jacket	P	G	E	F	P	E
Polybutene	Isobutylene Polymer	Not vulcanizable. Rubber-like. Mixed with resins or rubber. Extrudable.	Insulation	E	E	E	F	P	P
Polythene	Ethylene Polymer	Thermoplastic. Extrudable.	Insulation	E	E	E	E	P	F
Soran	Vinylidene chloride-Vinyl chloride Copolymer	Thermoplastic. Applicable as threads or tapes.	Insulation	F	E	E	G	E	E
Tenite II or Kodapak	Cellulose Derivative	Thermoplastic. Extrudable or applicable as tapes. Cellulose-acetate-butyrate.	Insulation	F	G	G	G	F	G
Ethyl Celluiose	Cellulose Derivative	Thermoplastic. Extrudable. Cellulose ethyl ether.	Insulation	F	G	G	G	F	G

E—Excellent, F—Fair, G—Good, P—Poor. Dielectric properties include dielectric strength, capacity, power factor, insulation resistance, etc. Chemical properties include resistance to oxidation, acids, alkali and moisture. Physical properties include tensile strength, elongation, modulus, toughness and abrasion resistance.

The ANNUAL MEDAL AWARD of the WIRE ASSOCIATION

FOR THE MOST MERITORIOUS PAPER ON WIRE MANUFACTURE OR FABRICATION DURING THE YEAR

All members of the Wire Association are cordially invited to submit technical papers either for publication in "WIRE & WIRE PRODUCTS" during the year or for presentation before the Annual Wire Association Convention.

An annual medal will be awarded in each of the two major divisions of the activities of the Association, to the papers coming nearest to the requirement set forth above.

Consideration for the Medal Awards is not limited to the papers presented at the Annual Meeting, but is given to all papers submitted by members and published in "WIRE & WIRE PRODUCTS" during the year.

Selection of papers to be presented at the Annual Convention rests in the hands of the Joint Programme Committee and the Board of Directors of the Wire Association.

All papers submitted become the property of the Wire Association and the Board of Directors constitutes the Committee on Awards.

Additional information may be obtained by addressing:

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The Wire Association
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Stamford, Connecticut

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THE Wire Association is a non-profit organization of wire mill executives, superintendents and foremen. It also includes plant engineers, traffic men, and all others engaged in the production of cold drawn bars, rods, wire, strip, insulated wire and cable, and the manufacture and fabrication of finished wire products, including cold headed, extruded and other cold worked metal products.

THERE are separate divisions for all the separate major interests in the wire industry, steel, iron, brass, copper, alloy, and precious metals, together with divisions relating to drawing, cold working, cold heading, extruding, fabricating, forming, spring making, wire cloth, wire rope, bare and covered electric wire and cable and all other forms of wire and wire products.

✦ ✦ ✦

PURPOSES

ITS specific purpose is to improve production methods and afford a clearing house for ideas on management problems, technical problems, and research work in all phases of practical wire drawing and wire working, and to develop and maintain friendly relations among the members.

✦ ✦ ✦

ACTIVITIES:

The Association functions along the following lines:

1. The use of the Association headquarters as a central clearing house for information and data of all kinds which may be of interest to members.
2. The exchange of ideas on processes of production including machinery, technical processes, etc.
3. The establishment and maintenance of friendly relations among the members of the association and the development of sectional and national meetings to discuss matters of mutual interest.
4. Studies of production methods and analysis of production costs.
5. Developments in the use of new materials and new applications of existing materials and by-products.
6. Research and collection of information on personnel management, including such factors as labor turnover, seasonal changes in the demand for employees, wage scales, etc.
7. Standardization and simplification as a means for the effective elimination of waste.
8. Such other subjects as may be determined upon.

PROGRAM

Wire Association Wartime Emergency Convention

Pittsburgh, Pa., October 16-19, 1944 Association Headquarters—William Penn Hotel

Wire Association Headquarters at The William Penn Hotel

Will Be Open from Monday, October 16, All Day and Every Evening During the Convention

—Come and Get Acquainted!

THERE WILL BE A REGISTRATION FEE OF $5.00 FOR THOSE ATTENDING THESE TECHNICAL SESSIONS AND INFORMAL MEETINGS

✦ ✦ ✦ ADMISSION WILL BE BY BADGE ONLY ✦ ✦ ✦

Open Discussions Will Be held On the Papers Presented and These Discussions Will be Published in the January, 1945, Issue of Wire and Wire Products

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Firth-Sterling Steel Co.,
McKeesport, Penna.

Hotel reservations should be made by members of The Wire Association direct to the Secretary prior to October 10, 1944. *Watch out for this — Make your plans now to attend and send your reservation card in promptly.*

MONDAY, OCTOBER 16 — 10:30 A. M. DIRECTORS' MEETING — 12 NOON PROGRAM COMMITTEE LUNCH

Registration and Information at William Penn Hotel — October 16-19 — in charge of Mrs. R. S. Spengel, Secy.-Treas., WIRE & WIRE PRODUCTS.

— The Technical Sessions —

ALL RESEARCH PAPERS ARE PREPRINTED IN THE OCTOBER ISSUE OF WIRE AND WIRE PRODUCTS

The Discussions and the Mordica Memorial Lecture Will be Printed in the January, 1945 Issue of Wire and Wire Products

MONDAY, OCTOBER 16 Afternoon Session — 2:30 P. M.	E. W. Gundstrom, Asst. Plant Manager, Chairman of Meeting	Rome Cable Corporation, Rome, N. Y.
OPENING ADDRESS	D. D. Buchanan	President of the Wire Association
LECTURE: "Safety in Wire Mills"	R. H. Ferguson, Manager of Safety,	Republic Steel Corporation, Cleveland, Ohio
LECTURE: "Handling Wire Mill Labor Problems"	John J. Sanderson, Asst. Supt. Wire Mills,	Keystone Steel & Wire Co., Peoria, Illinois
TUESDAY, OCTOBER 17 Morning Session — 9:30 A. M.	Julian L. Schueler, General Superintendent Chairman of Meeting	Continental Steel Corp., Kokomo, Ind.
PAPER: "Cleaninghouse Practices"	F. P. Spruance, Vice-President,	American Chemical Paint Co., Ambler, Pa.
PAPER: "A Reappraisal of Electro-galvanizing"	Ernest H. Lyons, Jr., Chief Chemist,	The Meaker Co., Chicago, Ill.
PAPER: "Variable Speed Transmissions for the Control of Tensions and Velocities in Processing Wire and Cable"	J. H. Gepfert, Engineer,	Reeves Pulley Co., Columbus, Ind.
TUESDAY, OCTOBER 17 Afternoon Session — 1:30 P. M.	W. H. Crawford, Resident Manager, Chairman of Meeting	Reliance Spring Washer Div., Eaton Mfg. Co., Massillon, Ohio
PAPER: "Some Factors Influencing the Drawing of Fine Wires"	H. P. Edinga, Factory Manager,	Wire Division, North American Philips Co., Dobbs Ferry, N. Y.
PAPER: "The Physical Properties of High Carbon Steel Rope Wire As Affected By Variations in Patenting."	Howard J. Godfrey, Development Engineer	John A. Roebling's Sons Co., Trenton, New Jersey
WEDNESDAY, OCTOBER 18 Morning Session — 10:00 A. M.	D. D. Buchanan, President, The Wire Association, Chairman	
PAPER: "Dies"	A. R. Zapp, Manager, Firthaloy Div.,	Firth-Sterling Steel Company, McKeesport, Pa.

THE MORDICA MEMORIAL LECTURE

To Be Presented By
A. M. Reeder,
Metallurgical Engineer,
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.

SUBJECT: "CARBON STEELS FOR THE WIRE INDUSTRY"

WEDNESDAY, OCTOBER 18
1:00 P. M.

WIRE ASSOCIATION LUNCHEON — WILLIAM PENN HOTEL

WIRE ASSOCIATION MEDAL AWARD FOR 1943

— GUEST SPEAKERS —

Captain Roger C. Heimer,
U. S. Coast Guard

Lieutenant Colonel Guy R. Mountfort,
Assistant Director of Ordnance Services, British Army Staff,
British Ministry of Supply, Washington, D. C.

(Members are at liberty to bring guests. Ladies are welcome)

WEDNESDAY, OCTOBER 18
4:00 P. M.

Wire Association Annual Meeting
D. D. Buchanan,
President, The Wire Association
CHAIRMAN OF MEETING

WILLIAM PENN HOTEL

WEDNESDAY, OCTOBER 18
Evening — 7:30 P. M.

ANNUAL DINNER — STAG SMOKER — WILLIAM PENN HOTEL

A. R. ZAPP,
Manager, Firthaloy Division,
Firth-Sterling Steel Company
McKeesport, Pa.
CHAIRMAN OF COMMITTEE

THURSDAY, OCTOBER 19
Morning Session — 9:45 A. M.

C. A. Litzler, Chief Engineer,
Chairman of Meeting
The Industrial Oven Engineering Co.,
Cleveland, Ohio

PAPER: "Synthetic Insulation and Jackets for Wire and Cable"
G. A. Rolston,
Chief Engineer,
Rome Cable Corp.,
Rome, N. Y.

PAPER: "Discussion on the New Plastic—Polythene and It's Adaptation for Insulation of Electric Wire and Cable, together with a Discussion of Plastic Used with Nylon in a New Switchette"
Dr. J. W. Shackleton,
Plastics Div.,
E. I. DuPont de Nemours Co.,
Wilmington, Delaware

THURSDAY, OCTOBER 19
Afternoon Session — 1:30 P. M.

H. W. Anderson, President
Chairman of Meeting
Fidelity Machine Co.,
Philadelphia, Pa.

PAPER: "Covering Weatherproof Cable"
H. Kaffine,
Chief Mech. Engr.,
Fidelity Machine Company,
Philadelphia, Pa.

PAPER: "Lacquers and Saturants"
Russ Jordan,
Engineer,
Ault & Wiborg,
Cincinnatti, Ohio

THE WIRE ASSOCIATION MEDAL AWARDS

For the Most Meritorious Paper on Wire Manufacture or Fabrication During the Year.

MEDAL AWARDS

1934 — EDWARD J. P. FISHER
Metallurgist, Keystone Steel & Wire Co., Peoria, Ill.
Title of Paper: "COLD DRAWN STEEL SPRING WIRE"

1935 — BENJAMIN LEWIS McCARTHY
Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Title of Paper: "GRAIN SIZE AND ITS INFLUENCE ON THE MANUFACTURE OF STEEL WIRE"

1936 — ROBERT NOTVEST
Chief Engineer, Welding Division, J. D. Adams Mfg. Co., Indianapolis, Indiana
Title of Paper:
"STEEL FOR ARC WELDING ELECTRODES"

1937 — BENJAMIN LEWIS McCARTHY
Chief Metallurgist, Wickwire Spencer Steel Co., Buffalo, N.Y.
Title of Paper:
"ABNORMAL GRAIN GROWTH AND THE ANNEALING OF LOW CARBON STEEL WIRE"

1938 — WALTER R. BLOXDORF
Metallurgist, The MacWhyte Co., Kenosha, Wis.
Title of Paper: "WIRE ROPE"

1939 — STANLEY P. WATKINS
Manager, Sales Development, Rustless Iron and Steel Corp., Baltimore, Maryland
Title of Paper:
"THE MANUFACTURE AND USE OF STAINLESS STEEL WIRE"

1940 — ROBERT W. SANDELIN
Metallurgist, Atlantic Steel Company, Atlanta, Georgia
Title of Paper:
"GALVANIZING CHARACTERISTICS OF DIFFERENT TYPES OF STEEL"

1941 — CARLETON W. GARRETT
Wire Mill Metallurgist, Jones & Laughlin Steel Corp. Aliquippa, Pennsylvania
Title of Paper:
"A BRIEF DISCUSSION ON THE MANUFACTURE OF STEEL FOR ARC WELDING ELECTRODES"

1942 — LEROY DEVOE SEYMOUR
Asst. Works Manager, Canada Works, Steel Company of Canada, Ltd., Hamilton, Ontario, Canada
Title of Paper:
"SCHEDULING AND PLANNING THE WIRE MILL FOR WAR PRODUCTION"

1943 — JOHN C. AIKEN
Asst. Supt., Rod and Wire Mills, Jones & Laughlin Steel Corp., Aliquippa, Pa.
Title of Paper: "DRAWING HIGH SPEED ROPE WIRE"

HONORABLE MENTIONS

1935 — L. D. SEYMOUR
Metallurgist, Rod and Wire Dept., Youngstown Sheet & Tube Co., Youngstown, Ohio
Title of Paper: "COLD HEADING WIRE"

1935 — R. A. SCHATZEL
Superintendent, General Research Laboratories, General Cable Corp., Rome, N. Y.
Title of Paper: "HARD AND SOFT COPPER WIRE"

1936 — BENJAMIN LEWIS McCARTHY
Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Title of Paper:
"PLASTIC DEFORMATION IN WIRE DRAWING"

1937 — ROBERT W. SANDELIN
Metallurgist, Atlantic Steel Co., Atlanta, Ga.
Title of Paper:
"A METALLURGICAL STUDY OF THE FACTORS AFFECTING THE QUALITY OF GALVANIZING"

1937 — ALLAN B. DOVE
Chemical Engineer, Canada Works, The Steel Company of Canada, Ltd., Hamilton, Ont., Canada.
Title of Paper:
"A. C. ELECTRO PICKLING—A BETTER METHOD OF PICKLING"

1938 — RODMAN R. TATNALL
Metallurgist, Morgan Works, Wickwire Spencer Steel Co., Worcester, Massachusetts
Title of Paper: "RESILIENCE OF SPRINGS"

1938 — JOSEPH A. DOYLE
Vice President, W. S. Rockwell Co., New York, N. Y.
Title of Paper: "HEATING COPPER WIRE BARS"

1940 — H. BLOUNT and J. D. WILTRAKIS
Mfg. Engineer, Point Breeze Works, Engineer, Kearny Works, Western Electric Company
Title of Paper:
"DESIGN AND OPERATION OF A NEW COPPER WIRE DRAWING PLANT"

1941 — RODMAN R. TATNALL
Metallurgist, Morgan Works, Wickwire Spencer Steel Co., Worcester, Massachusetts
Title of Paper:
"TIME, TEMPERATURE AND SIZE IN THE HEATING OF STEEL WIRE"

1942 — COLONEL FRANK W. BULLOCK
Signal Corps, United States Army
Title of Paper: "THE WIRE INDUSTRY IN WAR"

1943 — E. J. CRUM
General Foreman, Bethanizing and Galvanizing Departments, Bethlehem Steel Company, Sparrows Point, Md.
Tile of Paper: "THE GRAPHICAL SOLUTION OF WIRE MILL MATHEMATICAL PROBLEMS"

ANNUAL MEDAL AWARD OF THE WIRE ASSOCIATION

FOR THE MOST MERITORIOUS PAPER ON WIRE MANUFACTURE OR FABRICATION DURING THE YEAR
— BY A MEMBER OF THE WIRE ASSOCIATION —

ALL members of the Wire Association are cordially invited to submit technical papers either for publication in "WIRE & WIRE PRODUCTS" during the year or for presentation before the Annual Wire Association Convention.

✦ ✦ ✦

AN annual medal will be awarded in each of the two major divisions of the activities of the Association, to the papers coming nearest to the requirement set forth above.

✦ ✦ ✦

CONSIDERATION for the Medal Awards is not limited to the papers presented at the Annual Meeting, but is given to all papers submitted by members and published in "WIRE & WIRE PRODUCTS" during the year.

✦ ✦ ✦

ADDITIONAL information may be obtained by addressing:

✦ ✦ ✦

SELECTION of papers to be presented at the Annual Convention rests in the hands of the Joint Program Committee and the Board of Directors of the Wire Association.

✦ ✦ ✦

ALL papers submitted become the property of the Wire Association and the Board of Directors constitutes the Committee on Awards.

✦ ✦ ✦

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(Please turn to Page 719)

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

OUR HEARTY GREETINGS

To the Members of

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MICRO WELDERS

Set the standard for the

WIRE INDUSTRY

and have pioneered many developments in welders for the field, and will shortly announce some additional new features that will further greatly improve the operating efficiency of these machines.

Models now available will handle high and low carbon rods and wire from .005" to 1.25" diameter, stainless steel, aluminum and aluminum alloys, and copper and copper alloys in sizes .007" to 1" diameter.

Mr. G. L. May of the Micro Products Company will be at the William Penn Hotel during the Convention.

Ask us about your welding problems.

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A WELDER FOR EVERY PURPOSE

Government Wire Production Information

Enemy Patents Available

ALIEN Property Custodian **James E. Markham** has announced that 2048 of 4802 patent applications that he vested as property of nationals of enemy and enemy-occupied countries have been successfully prosecuted by his office and patents have been issued to him.

✦ ✦ ✦

THE Custodian explained that as a result of the prosecution of these patents many new inventions and processes have been made available for war production and to those interested in planning peacetime production.

✦ ✦ ✦

EARLY in 1943 the Custodian's office, in order to make technical knowledge available at a time when it was critically needed, provided for publication of and encouraged wide dissemination of the specifications of these patent applications.

✦ ✦ ✦

MR. MARKHAM said that rather than allow these 4,800 patent applications to remain in the files of the Patent Office, where they would make no widespread contribution to victory and to the American economy, his office felt the effort necessary to have patents issued has been worthwhile. These patents, like others held by APC, if of enemy origin, are freely available to Americans under royalty-free, non-exclusive licenses for $15 each. Royalties are now charged on patents formerly owned by residents of enemy occupied countries, he pointed out.

✦ ✦ ✦

SOME of the new scientific developments now available as a result of these patents include the manufacture of magnesium from magnesite, reduction of glare from lenses and a substitute for litmus (used in chemical testing).

(Please turn to Page 704)

ROSS "Universal" Welding Rod OVENS

PAT. PENDING

Handle all types and sizes.
Controlled zones of heat and circulation.
Rods carried from pass to pass without jamming or marking.

Built in multipass and single pass continuous types, these modern ROSS "Universal" Ovens can be installed to process from 200 to 1200 rods per minute. Maximum flexibility of operation for handling any type of coated rod. Uniform control of air temperature, circulation and humidity throughout heating zones assures speedy production of hard, firm, dry coated rods, regardless of type.

ROSS "Universal" Ovens are used by such leaders as:—Arcrods Corporation in five plants; Metal & Thermit Co.; The McKay Co.; Harnishchfeger Co.; A. O. Smith Co.; Westinghouse Electric & Mfg. Co.; General Electric of Canada—and many others.

ROSS SYSTEMS

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CHICAGO 6—201 N. Wells St. DETROIT 3—12953 Greeley Ave.

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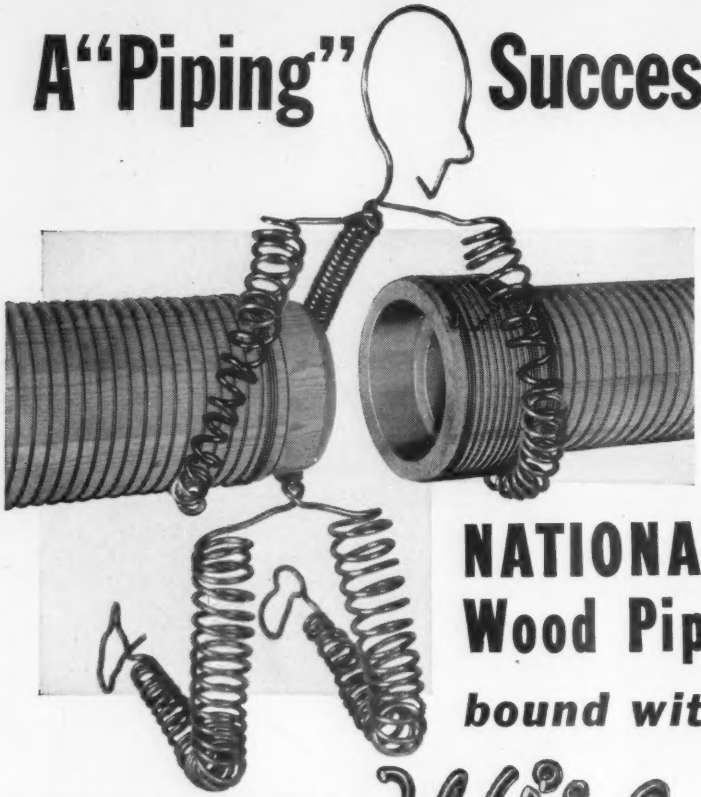
A "Piping" Success



NATIONAL Wood Pipe* bound with KEYSTONE Wire

NATIONAL QUALITY Wood Pipe "carries the water" today in many army camps, irrigation projects and municipal water systems.

The strength and long-lasting qualities of NATIONAL Wood Pipe are assured by the specially-treated wood and heavily galvanized Keystone wire, plus an outside coating of coal tar and pitch.

Again, we are pleased that Keystone Pipe-Winding wire fulfills this important role in the manufacture of NATIONAL QUALITY Wood Pipe.

KEYSTONE STEEL and WIRE CO.

Peoria 7, Illinois

*National Tank & Pipe Co., Portland, Oregon

Special Analysis Wire for All Industrial Uses

SAMSON SPRING WIRE

Coppered, Tinned, Annealed, Galvanized

Government Wire Production Information

(Continued from Page 703)

APC as a result of prosecuting the patent applications, now has patents on many special machines—riveting, molding, ball-bearing finishing, screw-threading, sheet-metal straightening, and spring making; also many new patents on measuring and testing methods. Among these are testing for hardness, thickness, gravity, fluid levels, weight, gauging and the amount of air.

✦ ✦ ✦

Synthetic Organic Soaps

TO assure more equitable distribution of synthetic organic soaps to industry, the War Production Board has placed these soaps under allocation control. This control is established by the addition of Schedule 44 to Order M-300, the general chemicals order.

✦ ✦ ✦

THIS allocation control applies only to supplies for the military services, and industry will continue to receive allotments in accordance with the established preference rating procedure now in effect, WPB said. This will assure the military of an adequate supply without resort to large stockpiling, it was explained.

✦ ✦ ✦

SYNTHETIC organic soaps have specialized military uses such as germicidal rinses, softening of salt water and for mobile laundries in combat areas.

✦ ✦ ✦

PRIORITY ratings will be granted to industry for these soaps to be used in the production of rubber, textiles, dye stuffs, leather, metal, pulp and paper, insecticides, germicides and dairy cleaners, and for special industrial purposes.

ADVERTISING keeps you posted on what is new and good in machinery, equipment and supplies. It reminds you of reliable sources. Buy with confidence from the concern who ADVERTISES.

Government Wire Production Information

Government Commends Industry for Achievement

PRODUCTION of copper wire and cable showed such a marked increase within the past 12 months that Government officials complimented both labor and management at a recent meeting of the Copper Wire and Cable Industry Advisory Committee. The Copper Division issued the following statement:

"The entire industry must be complimented on the extremely able job of production for war that has been accomplished in spite of handicaps and adverse operating conditions.

"The copper wire and cable industry was once keyed to manufacture its products under known industrial and consumer specifications, using crude rubber and components with which they had had years of experience.

"Since 1942, however, the industry has converted its facilities and equipment to produce types of wires and cable unknown or little used in the pre-war period. In addition, due to shortages of component materials, chiefly rubber, new engineering practices and techniques have had to be developed to obtain satisfactory production in the use of such materials as Buna S synthetic rubber, Polyethylene, and other components involving no previous experience.

"Many troubles and difficulties were encountered, but all were eventually met by the industry. Production is now definitely on the upgrade and shipments have shown a steady increase during the past year despite insufficient labor and shortages of necessary components such as steel wire, cotton, yarn and rubber.

"This has been due to the untiring efforts of the workers in the mills, the research and engineering staffs and the managements."

✦ ✦ ✦

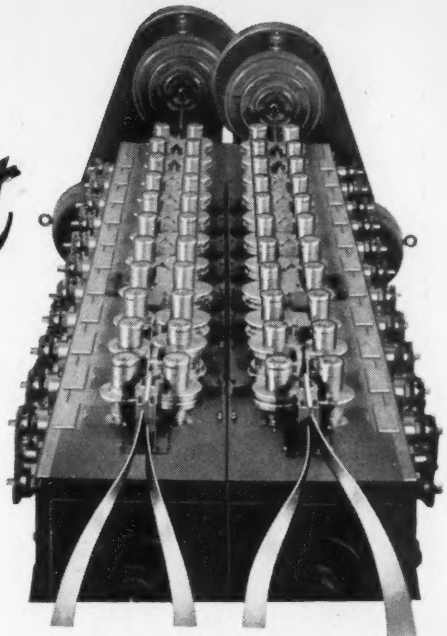
WPB officials stressed the urgent need for even greater production to meet the still rising military needs occasioned by actual battle experiences overseas.

✦ ✦ ✦

COMMITTEE members agreed that every step should be taken to meet these military requirements and recommended that additional labor be made available for the operation of their mills. They expressed the opinion that specifications of the armed serv-

(Please turn to Page 706)

Strip Act THAT ADDS TO PRODUCTION



WHEN ROEBLING Strip Steel glides through the forming rolls one fact becomes immediately apparent: QUALITY!

Matching the specifications of the job — steel analysis, dimensions, finish — this Roebling *strip* act proves once again that Roebling men know steel . . . *are* wire specialists.

So, for strip steel or flat wire that is speedy and smooth in punching, shearing or drawing operations . . . rely on Roebling — and that goes for our round and shaped wire, too! All are built to exacting standards and specifications that will help you turn out the *profitable* production *you* want.

JOHN A. ROEBLING'S SONS COMPANY
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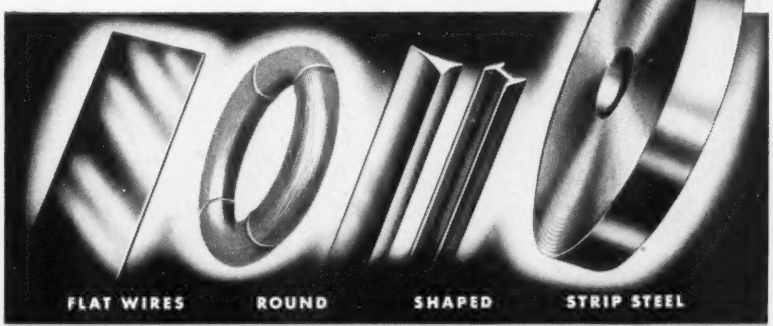

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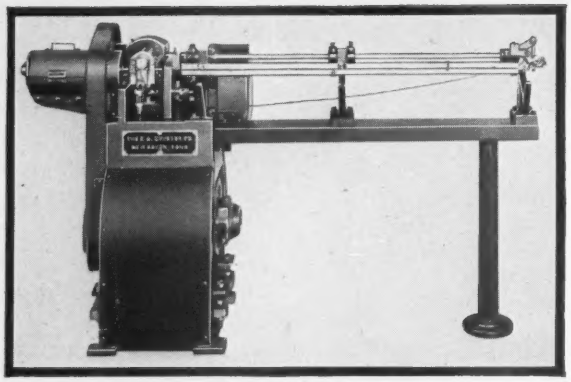
WIRE ROPE AND STRAND • FITTINGS • AERIAL WIRE ROPE SYSTEMS • COLD ROLLED STRIP • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • ROUND AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • WIRE CLOTH AND NETTING AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • SUSPENSION BRIDGES AND CABLES



SHUSTER WIRE STRAIGHTENER TYPE A

Wire Capacity 1/32" - 1/16" Diameter

Faster Cutting Speeds

GREATER PRODUCTION!

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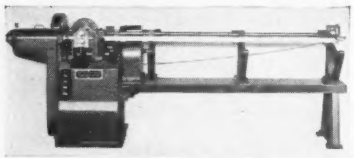
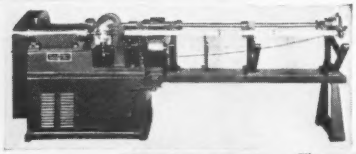
Outstanding Features —

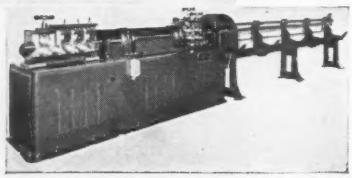
Almost continuous wire travel
Lightning cut-off assures square-cut ends
High speed, direct driven 5-die straightening flier
Quiet, highly efficient V-belt motor drive
Ball and roller bearings throughout
Extremely rigid construction
Fully guaranteed as to material and workmanship.
Further details on request.



Type 1A
$\frac{1}{16}$" - $\frac{3}{16}$" Dia.



Type 2A
$\frac{1}{8}$" - $\frac{1}{4}$" Dia.



Type 3A
$\frac{3}{16}$" - $\frac{3}{8}$" Dia.

Type 4A (not shown)
$\frac{3}{8}$" - $\frac{5}{8}$" Dia.

The F. B. Shuster Mfg. Co., Inc., New Haven, Conn.

SHUSTER

Automatic

WIRE STRAIGHTENING

AND CUTTING

MACHINES

Since 1866

Government Wire Production Information

(Continued from Page 705)

ices should be reviewed. Possible relaxations in certain specifications would permit increased production, committeemen said.

✦ ✦ ✦

PROBLEMS that will confront the industry as a result of future cutbacks contract cancellations and reconversion to civilian production were also discussed. Committee members are expected to make specific recommendations relative to these problems at future meetings.

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Aluminum Allocation Changes

THE War Production Board has discontinued allotting aluminum in the eight specified forms, and hereafter will use the word "aluminum" to indicate any and all of these forms, WPB announced today. This action was taken by issuing Direction 56 to Controlled Materials Plan Regulation No. 1.

✦ ✦ ✦

PREVIOUSLY WPB allotted aluminum in the following eight forms: (1) rod, bar, wire and cable; (2) rivets; (3) forgings, pressings and impact extrusions; (4) castings before machining; (5) sheet, strip, plate and foil; (6) tubing; (7) tube blooms and (8) ingot and powder.

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OFFICIALS explained, however, that consumers' applications to WPB must continue to specify the particular forms of aluminum desired.

✦ ✦ ✦

A PERSON who has received an allotment in terms of the eight forms may combine such allotments into one account. He may thereafter make allotments to his suppliers in terms of "aluminum" without further specification. In placing authorized controlled material orders for aluminum, he may charge them against

such a single account, irrespective of the forms or shapes desired.

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OFFICIALS further explained that if a person receives an allotment in one or more of the specified shapes, he may treat it as an allotment of "aluminum" without regard to such shapes.

✦ ✦ ✦

Brass Rod Production Reached All Time High in August

BRASS rod production reached an all-time monthly record of approximately 94,000,000 pounds during August, according to a preliminary check made by Copper Division officials, of the War Production Board.

✦ ✦ ✦

THIS record, reported at a recent meeting of the Brass Mill Industry Advisory Committee, indicates that the plant expansion program is well ahead of schedule. Output of all other brass mill products is in balance with production schedules set by WPB.

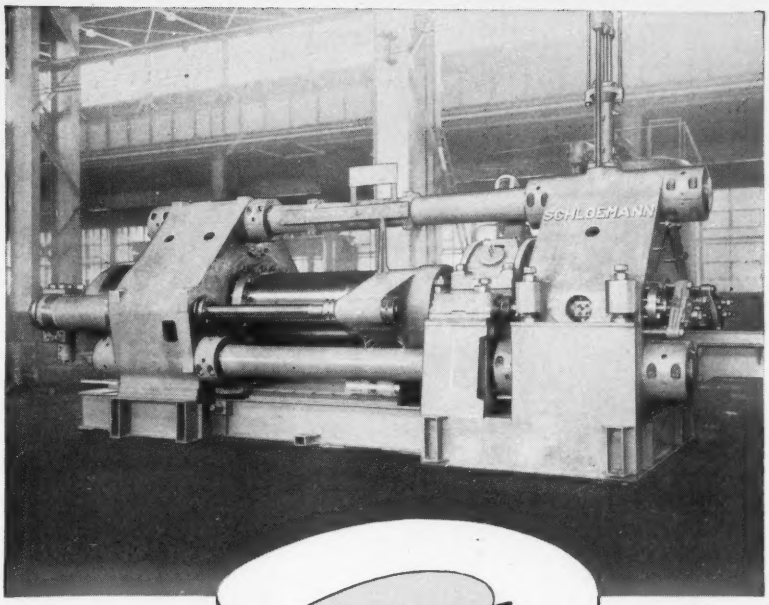
✦ ✦ ✦

GOVERNMENT representatives also indicated that unless projected requirements are materially altered, the cessation of European hostilities will result in reduced military demand for copper and copper products to an extent permitting revocation of Copper Conservation Order M-9-c.

✦ ✦ ✦

NECESSARY controls will be maintained to give precedence to military orders, following Germany's defeat. Each brass mill will be expected to take care of other requirements of all consumers on an equitable basis, WPB said.

Our advertising pages — have you studied them carefully? They contain information to guide you in the successful operation of your business. And when you write an advertiser for prices, catalogs or detailed data, won't you please say you saw his ad in WIRE AND WIRE PRODUCTS.



Do You Extrude..

- BARS AND RODS
- TUBULAR PRODUCTS
- STRIP AND WIRE ROD
- ANY KIND OF SECTIONS

SCHLOEMANN presses assure the greatest possible efficiency in extrusion operations—an assurance based on:

✓ High quality of products extruded
✓ Dependability of performance
✓ Ease of operation
✓ Low cost of operation and maintenance
✓ Great range of sizes obtainable from one installation

Benefit by these advantages. Permit the experience and skill of Schloemann engineers to increase your production.

SCHLOEMANN
ENGINEERING CORPORATION

1194 Empire Bldg., Pittsburgh, Pa.

HYDRAULIC PRESSES • ROLLING MILL MACHINERY

New Ceramic Wire Insulation Withstands 200° C. Continuous Operating Temperatures

CULMINATING seven years of continuous research, the **Sprague Electric Company**, North Adams, Mass., has evolved a process for depositing a thin ceramic (inorganic) coating on copper, nickel, and other types of wire.

✦ ✦ ✦

THIS new insulation is known as Sprague CEROC 200. When applied to copper wire it maintains desirable electrical characteristics at a continuous operating temperature of 200° C. as compared to the present limit of 105° C. for conventional Class A insulations such as enamels, varnishes, and other organic materials. Thus, by designing motors, transformers, chokes, and similar equipment to utilize the full maximum operating temperature of CEROC 200, a substantial increase in volt ampere rating can be obtained. Smaller-sized equipment can be designed to do larger-sized jobs.

✦ ✦ ✦

BECAUSE of its inorganic ceramic composition, Sprague engineers believe that CEROC 200 meets all requisites of a Class C insulating material as classified under A.I.E.E. standards. Space factor is extremely good, in that CEROC 200 is thinly deposited on the wire. Typical space factor for CEROC 200 expressed in percentage of copper area to total cross-sectional area of finished wire is 96% for AWG No. 21 wire, and 95% for No. 24 wire by comparison with 69% and 59% respectively for other types of insulation that might be used for similar high temperature applications.

✦ ✦ ✦

ANOTHER important feature is the high degree of thermal conductivity of CEROC 200. Both because of the favorable space factor and the ceramic composition of this insulation, coils wound with it dissipate heat rapidly. There is little or no tendency toward the development of hot spots which would nullify a large percentage of the high temperature gain that might otherwise be expected. Thus the high temperature advantages of CEROC 200 are real and not apparent.

✦ ✦ ✦

THE preferred thickness of CEROC 200 is ¼ mil. The coating is extremely uniform and makes for smooth, level winding in a minimum of space. Present preferred wire sizes for applying CEROC 200 are from 3 to 30 mils in copper wire (No. 40 to No. 21 AWG) and from 1½ to 12 mils (No. 46 to No. 28) in nickel wire.

✦ ✦ ✦

CEROC 200 is flexible enough so that round coils can be wound satisfactorily on existing equipment. In the case of rectangular coils or motor armatures, however,

WILLEY'S SIZING, EXTRUSION AND WIRE DRAWING DIES

Sales Engineers in Principal Cities.

They are made from a specially developed grade of Tungsten Carbide having those characteristics needed for dies—freedom from porosity, great abrasion resistance and the ability to take a polish equal to that of diamonds.

FOUR CLASSIFICATIONS OF WILLEY'S DIES

A. Blank and rough cored nibs.
B. Rough cored dies (cased).
C. Semi-finished, rough drilled dies (cased).
D. Finished dies, ready for use.

WRITE FOR NEW CATALOG 27

Gives full information on Willey's Dies in addition to other standard tools.

Standard Sizes from .325 to 4.000. Special Sizes and Shapes Made to Order.

WILLEY'S CARBIDE TOOL CO.
1340 W. Vernor Highway, Detroit, Michigan

winding technique may require modification to assure that the wire is not stretched more than 10%.

✦ ✦ ✦

ALTHOUGH now announced generally for the first time, CEROC 200 has been supplied in large quantities for some months past for important war equipment uses.

✦ ✦ ✦

A NEW bulletin describing this important development will be sent on request to the manufacturer. Samples will be supplied to interested manufacturers.

✦ ✦ ✦

Bristol Announces New Line of Automatic Control Instruments Operating On Electronic Principle

A NEW electronic-type controller, known as Bristol's Free-Vane Electronic Controller, has just been announced by **The Bristol Company**, Waterbury 91, Connecticut. The new line of controllers operates on the shielding effect of a vane passing between two coils in an electronic circuit. Recording and indicating models are offered for automatic control of temperature, pressure, liquid level, and humidity. The following types of control operation are available: low-open, high-open, low-high, low-open-high, and low-normal-high.

✦ ✦ ✦

THE new controller for temperature is offered in ranges from —125°F. to +1000°F. for use in conjunction with motor and solenoid valves, relays, main line switches, and other fuel control apparatus for controlling the temperature in electric, oil, gas fired, and steam-heated ovens, dryers, dehydrators, oil baths, tanks, and other similar industrial apparatus.

MORE complete information is given in a new Bulletin B220.

✦ ✦ ✦

Bulletin On Air-Cooled Speed Reducing Unit

THE **Cleveland Worm and Gear Company**, Cleveland, Ohio, has published a four page illustrated bulletin which embodies a concise description of the new Speedaire Fan Cooled Worm Gear Reduction Units. A large illustration in the center spread of this bulletin shows just how the high velocity air stream is held on a directed course by the double wall housing, how the heat-dissipating surface is nearly doubled by integrally cast fins on the outer wall of the housing. It is pointed out that this construction delivers up to twice the horsepower capacity obtainable from standard type worm reducers of equal size, when operated at the usual motor speeds.

WAR calls for a lot of WIRE
WIRE • SCREEN WIRE CLOTH
POULTRY NETTING • NAILS
● From the fighting front, all the way back to the production line, wire has innumerable war jobs to do—tough tasks that show up just how good modern wire can be made. Cortland Wire is in service on many fighting and production fronts, performing essential tasks that generally are unseen and unsung.
Whether it is for armor wire, wire cloth for airplane air filters, aircraft engine casting pins, or wire for the common nail, performance is the real measure of wire value. And on the basis of performance, Cortland Wire has been exceeding the strictest specifications—the result of Cortland's more than 70 year experience in making America's finest wire and wire products.
WICKWIRE BROTHERS, INC.
CORTLAND, NEW YORK
Cortland Brands
WICKWIRE IS WARWIRE
Life at sea does things to electric cable—and finely-drawn, tough, corrosion-resistant steel wire, woven in a special basket-weave pattern, protects cable, giving it strength and flexibility to "take it."
Supplying this wire is another duration job assigned to Wickwire Brothers, Inc., because of a peacetime reputation for making highest-quality wire.

A Review of Recent Wire Patents

No. 2,355,018, COVERED ELECTRICAL CONDUCTOR, patented August 1, 1944, by Clyde N. Stover, Towson, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

The novelty resides in the provision of two knitted coverings about the wire conductor, with the ribs formed by the knots along the base of the courses extending in one direction on one covering and in the opposite direction on the other covering, said ribs lying between the coverings.

✦ ✦ ✦

No. 2,355,019, METHOD OF AND APPARATUS FOR MAKING A KNITTED COVERING OR COVERINGS ON A STRAND, patented August 1, 1944, by Clyde N. Stover, Towson, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This patent includes claims to the method of knitting the fabric of patent No. 2,355,018.

✦ ✦ ✦

No. 2,355,159, WIRE FABRIC LOOM, patented August 8, 1944, by Noah S. Harter, Waukegan, Ill., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents; outside United States and Canada, $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

A new means for interweaving the warp and weft wires is provided, having both fixed and movable weft wire guides secured both to a fixed part of the machine and to the heater frame of the loom, there being a flexible conduit secured at its opposite ends to the fixed and movable guides.

✦ ✦ ✦

No. 2,355,174, METHOD AND APPARATUS FOR SURFACE CONDITIONING WIRE AND THE LIKE, patented August 8, 1944, by Norman H. Nye, Cuyahoga Falls, and Edwin J. McIlvried, Akron, Ohio, assignors to The Vaughn Machinery Company, Cuyahoga Falls, Ohio, a corporation of Ohio.

This method comprises continuously advancing the wire from supply to the take-up, engaging the wire, intermediate the supply and take-up, with gripping means in such manner that there is sufficient friction to move the wire arcuately and insufficient friction to prevent said advancing thereof, rapidly oscillating the gripping means about the axis of the wire and conditioning the entire peripheral surface of the wire by engaging the same with grinding means while being thus oscillated.

✦ ✦ ✦

No. 2,355,538, COIL WINDING APPARATUS, patented August 8, 1944, by Edwin H. Lane, La Grange, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

The apparatus includes a longitudinally indexable coupling for supporting one end of the winding arbor, the coupling including a pair of stops for supporting the arbor in different longitudinal positions, one of the stops being fixed and the other being micrometrically adjustable to and from the first stop.

✦ ✦ ✦

No. 2,355,955, SELF-CLINCHING NAIL, patented August 15, 1944, by Harry G. Cummings, New York, N. Y.

Particularly adapted for attaching laminated wallboard to a support, this nail has a double shank with one end provided with a head and the other shank longer.

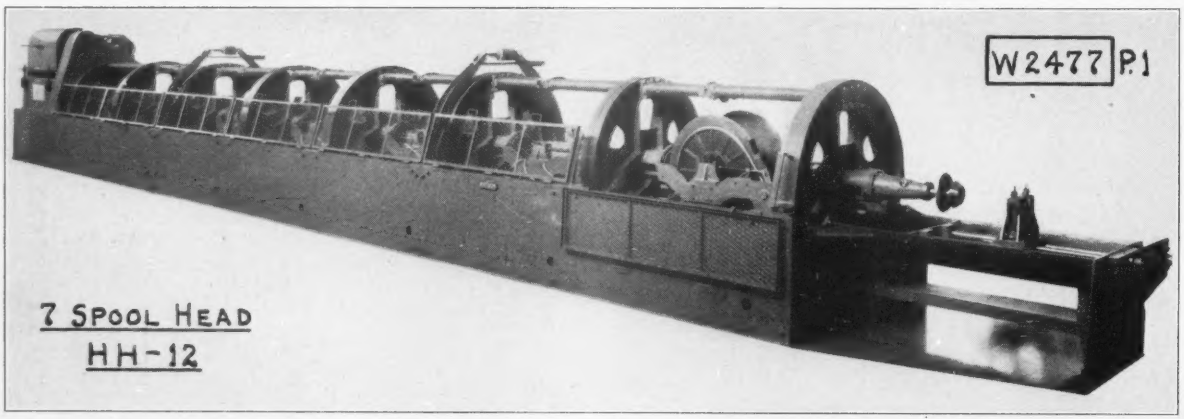
THE WATSON MACHINE COMPANY
PATERSON, NEW JERSEY, U.S.A.

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

CAGE TYPE HIGH SPEED CLOSING HEADS — "HH"

ALL-STEEL, TWIN-SPAN-BAR, MICARTA ANTI-FRICTION BEARING SUPPORTED ROTOR, WITH TWO-SPEED DIRECT-CONNECTED VEE-BELT DRIVE AND AUTOMATIC AIR SERVED BRAKES (for plant air supply).

LOW LEAD ANGLES AND OPEN CONSTRUCTION FACILITATE OPERATORS FUNCTIONS. OFFERED IN FOUR SIZES, LOADING 24", 30", 40" and 44" SPOOLS IN 7 and 9 SPOOL (in rotor) CONSTRUCTION.



DATA FOLLOWING APPLIES TO 7-SPOOL NO. 12" HEAD (Cut W-2477-P1) shown above:-

10-TON ROPE CAPACITY. SPOOLS 40" DIA. x 20" TRAVERSE (4000-lb. max. loaded Weight). 1/2" to 1 1/2" ROPE RANGE. 240 & 175 R.P.M. TWO-SPEED 50 H.P. DRIVE.

No. 2-355,963, WIRE FABRIC, patented August 15, 1944, by William Trehane Ennor, Newark, Ohio, assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania.

Aluminum wire fabric is woven, according to this method, of warp and weft wires having aluminum base alloy coils and coatings of heat-treated aluminum base alloy.

✦ ✦ ✦

No. 2,356,897, PROCESS FOR ELECTRODEPOSITION OF METAL, patented August 20, 1944, by James R. Stack, deceased, late of Montpelier, Vt., by Alvilda L. Stack, executrix, Pittsburgh, Pa., assignor to Nassau Smelting & Refining Company, Incorporated, New York, N. Y., a corporation of New York.

Metals of the group consisting of copper, tin and lead are heated by electrolyzing an electrolytic bath, consisting solely of an aqueous solution of this group with an insoluble anode made of an alloy consisting of lead and antimony in which the amount of antimony present is at least about 20% of the total composition but is insufficient to materially increase the operating voltage over that required with such an anode containing about 20% of antimony.

✦ ✦ ✦

No. 2,357,168, WIRE-ENAMELING APPARATUS, patented August 20, 1944, by Carl Bruining, Muskegon, Mich., assignor to Anaconda Wire and Cable Company, a corporation of Delaware.

In this apparatus, the die may adjust itself to irregular movement of the wire.

No. 2,357,276, CORROSION INHIBITING COATING COMPOSITION, patented August 29, 1944, by Aaron Wachter, San Francisco, Calif., assignor to Shell Development Company, San Francisco, Calif., a corporation of Delaware.

The coating is adapted to protect, against corrosion, ferrous metal surfaces in contact with hydrocarbons containing small amounts of water, and comprises sodium nitrate and a plasticized mucilaginous base consisting of a plasticizer, such as the polyhydric alcohols, and "modified starch".

✦ ✦ ✦

Bulletin On New Air Scrubber

A NEW bulletin describing the Ross Air Scrubber has just been published by the **J. O. Ross Engineering Corporation.**

✦ ✦ ✦

UNLIKE many types of air washers heretofore available, this Ross Scrubber contains no spray nozzles and requires no extensive piping to install, features that eliminate the usual sources of trouble and expense, it is claimed. These Ross Scrubbers not only thoroughly clean air but are designed for use in humidifying, cooling and fume elimination. The bulletin explains how they can also be utilized to heat white water or fresh water without the need for steam and a schematic layout for such water heating is included.

✦ ✦ ✦

COPIES of this bulletin, No. 205, may be had by writing to the J. O. Ross Engineering Corporation at 350 Madison Ave., New York 17, N. Y. or to branch offices at 201 N. Wells St., Chicago 6, Ill. or 12953 Greeley Ave., Detroit 3, Mich.

If You Are Not A Member of The Wire Association — Now Is A Good Time to Join!

The Annual Dues Are $10.00—

For detailed information address

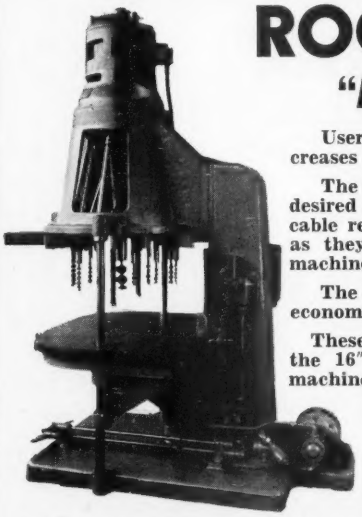
RICHARD E. BROWN, Secretary

THE WIRE ASSOCIATION

300 Main Street, Stamford, Conn.

ROOT CABLE REEL BORERS

"A Cable Reel Side Bored with Each Feed Stroke"



Root Style "AMH" 27" Round Hood Cable Reel Borer

Users of these borers report production increases up to 500%.

The adjustable spindles are centered for the desired pattern of holes. After that assembled cable reel sides will be accurately bored as fast as they can be handled into and out of the machine.

The hydraulic table feed assures unsurpassed economy of production and maintenance.

These borers are built in three sizes, the 16" diameter hood single column machine will handle cable reel sides up to 32", the 27" diameter hood single column machine up to 42" diameter and reels and the 40" diameter hood double column machine up to 84" capacity reel sides. Larger capacity machines built on order.

Root Style "AMRH" 40" Double Column Round Hood Cable Reel Borer.

Let Root solve your cable reel boring problems. Send us blueprints of your reel boring jobs.

B. M. ROOT CO.

YORK, PENNA., U. S. A.

Wire Association Convention Highlights

The Mordica Memorial Lecture

IN memory of **John Mordica,** the first president of the Wire Association, each year the Association selects a metallurgist whose work has been outstanding to present what is known as the Mordica Memorial Lecture. This year the lecture will be delivered by **M. A. Reeder,** Metallurgical Engineer, of Jones & Laughlin Steel Corp., Pittsburgh, Penna., on the subject of "Carbon Steels for the Wire Industry."

✦ ✦ ✦

The Annual Wire Association Luncheon

AT the luncheon this year, which will be held at the William Penn Hotel on Wednesday, October 18th, at 1 P. M., the award of the Annual Wire Association Medal and Honorable Mention Certificates for 1943 will be made.

BECAUSE of war conditions the recipients of both the medal and Honorable Mention will only receive certificates at this time. The medal will be delivered after the war when metal is allowed to be used again for this purpose. The honor of winning the medal for 1943 goes to John C. Aiken, Asst. Supt., Rod and Wire Mills, Jones & Laughlin Steel Corp., Aliquippa, Pa., and the Honorable Mention award to E. J. Crum, General Foreman, Bethanizing and Galvanizing Departments, Bethlehem Steel Co., Sparrows Point, Md.

✦ ✦ ✦

SPEAKERS from the United States Coast Guard and the Liaison Commission of the British Embassy, Washington, will present interesting addresses.

✦ ✦ ✦

Changes in Tentative Program

SEVERAL changes have been made in the Tentative Program sent to the members sometime ago and these changes follow:

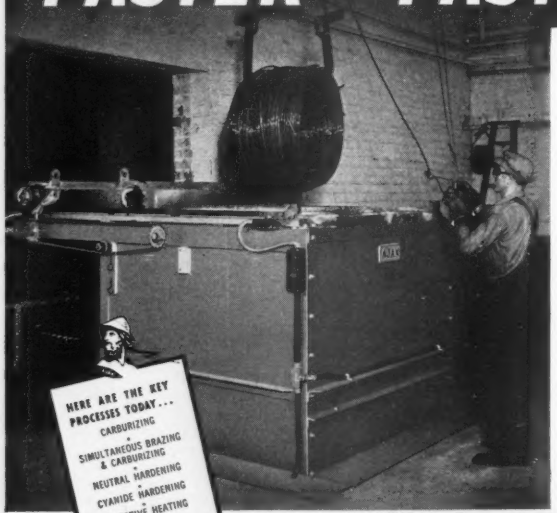
✦ ✦ ✦

THE following papers have been withdrawn: The paper entitled "Descaling of Steel and Wire Products and Future Method of Production," by J. J. Caugherty, Los Angeles, Calif. The paper entitled "Heat Treating of Rod and Wire," by Harry Dobrin, Chief Engineer, Furnace Engineers, Inc., Pittsburgh, Penna. The paper entitled "Dissertation on Light Metal versus Copper Wire," by S. W. Ahrens, Wopis Industrial Laboratory, New York, N. Y. The following papers have been added: The paper entitled "The Physical Properties of High Carbon Steel Rope Wire As Affected by Variations in Patenting," by Howard J. Godfrey, Development Engr., John A. Roebling's Sons Co., Trenton, New Jersey.

✦ ✦ ✦

THE following papers were not received in time for preprinting but will be printed in the No-

FASTER ··· FASTER ANNEALING!



Extremely fast heating is characteristic of the electric salt bath furnace, and the value of this cannot be exaggerated. The entire annealing cycle is accomplished in minutes (rarely more than 20) compared with hours required with other types of furnaces.

The 150-KW unit shown is capable of annealing high carbon SAE 52100 steel wire at an hourly production of 1500 lbs. If you have not yet investigated the remarkable adaptability of Ajax-Hultgren furnaces to your production program, it will pay you to investigate immediately. Nearly two thousand installations already made for various types of heat-treating, from 350 to 2400 deg. F. *Investigate the new Ajax Isothermal Heat Treatment process, which includes austempering, martempering, cyclic annealing. Send for descriptive pamphlet.*

Write for Catalog 107-B, Ajax Electric Co., Inc., Frankford Ave., at Delaware Ave., Philadelphia 23, Pa.

SEE AJAX, BOOTH C-340, MAIN EXHIBITION HALL DURING THE NATIONAL METAL CONGRESS AT CLEVELAND

THE AJAX HULTGREN ELECTRIC SALT BATH FURNACE

SELF-FEEDING • SELF-CIRCULATING

ASSOCIATE COMPANIES: AJAX METAL COMPANY, *Non-Ferrous Ingot Metal for Foundry Use*; AJAX ELECTRIC FURNACE CORPORATION, *Ajax-Wyatt Induction Furnaces for Melting*; AJAX ELECTROTHERMIC CORPORATION, *Ajax-Northrup Induction Furnaces for Melting, Heat-Treating*

vember and December issues of Wire and Wire Products: The paper entitled "Dies," by A. R. Zapp, Manager, Firthaloy Div., Firth-Sterling Steel Company, McKeesport. Penna. The paper entitled "Covering Weatherproof Cable," by H. Kaffine, Chief Mech. Engr., Fidelity Machine Company, Philadelphia, Pa. The paper entitled "Lacquers and Saturants," by Russ Jordan, Engineer, Ault & Wiborg, Cincinnati, Ohio. The discussion entitled "Handling Wire Mill Labor Problems," by John J. Sanderson, Asst. Supt. Wire Mills, Keystone Steel & Wire Co., Peoria, Illinois, will not be printed, but will be presented as an "off the record" presentation.

✦ ✦ ✦

"Covering Weatherproof Cable" By H. Kaffine, Chief Mechanical Engineer, Fidelity Machine Co., Philadelphia, Pa.

THIS paper, not received in time for preprinting will be presented at the Wire Association Convention in Pittsburgh and will give the following information:

I. Definition of weatherproof conductor.

II. Applications for weatherproof conductors.

III. Process of manufacturing the fibrous covering of the conductor.

A—Producing the braided covering.

B—Producing the knitted covering.

1. **Type of knitted covering.**
2. **Arrangement of mechanical details.**
3. **Development of formula and tables for estimating amount of cotton covering for various sizes of wire which will meet with the A.S.A. specifications.**
4. **Performance of knitting machine.**
5. **Comparative data as to installation costs, floor space and production—efficiency of Knitter versus Braider.**

C—Application of Saturant and Finish unto the fibrous covering.

D—Test requirements for finished weatherproof conductor to meet specifications.

E—Illustration of the various stages of producing weatherproof cable by silent motion picture film.

This is an invitation for you to become a member of The Wire Association. ✦ ✦ ✦ ✦ ✦ ✦

The Annual Dues are $10.00

"Tungsten Carbide Dies" by A. R. Zapp, Manager, Firthaloy Div., Firth-Sterling Steel Co. Pittsburgh, Pa.

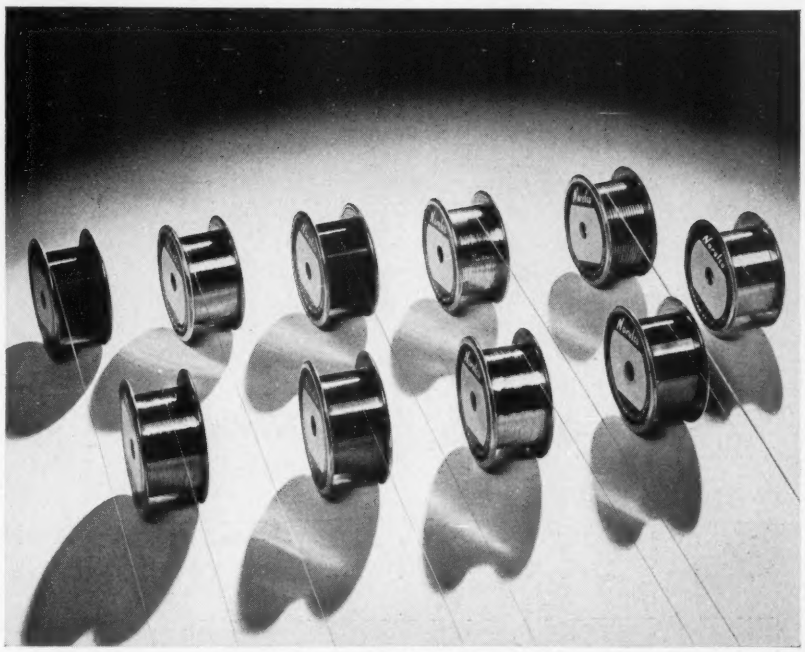
IN the September, 1944 issue of Wire and Wire Products a paper by **Mr. Zapp** entitled "The History and Development of Tungsten Carbide Dies," was presented.

✦ ✦ ✦

THE current paper follows up the historical data there presented with concrete information as to present uses of Tungsten Carbide Dies, including data on some of the newer mill applications such as extruding, heading to 1", bolt making, ball bearing manufacture, nails and use in connection with stainless steels.

✦ ✦ ✦

THIS paper will be printed in the November 1944, issue of Wire & Wire Products.



Why we are known as

FINE WIRE SPECIALISTS

Drawing fine wire with rigid requirements of close tolerance, perfect roundness and faultless surface condition is an every day production accomplishment at North American Philips.

If your specifications call for fine wire below .003 diameter in silver, nickel, copper, aluminum alloy, resistance wire, or plated wires up to .010 such as gold, copper and nickel on silver, tungsten, molybdenum, alloys, etc., we solicit your inquiry.

Manufacturers look upon North American Philips as fine wire specialists because we have:

Efficient equipment designed by us to meet our own exacting specifications • Superior craftsmanship • A specialized engineering service • Knowledge of processes and techniques developed by a technical organization with a background of over fifty years' experience in its fields.

An increasing number of manufacturers are finding our specialized skill of value in helping them meet wartime production schedules with low losses. Why not bring us your fine wire problems?

NORELCO PRODUCTS · Also diamond dies for our own drawing; Tungsten and Molybdenum products; Quartz Oscillator Plates; Amplifier, Transmitting, Rectifier and Cathode Ray Tubes; Searchray (X-ray) Equipment; X-ray Diffraction Apparatus; Medical X-ray Equipment, Tubes and Accessories; Electronic Measuring Instruments; High Frequency Heating Equipment: Communications Equipment. • When in New York, visit our Industrial Showroom

Norelco Reg. U. S. Pat. Off. *Electronic Products by* **NORTH AMERICAN PHILIPS COMPANY, INC.**

Dept. WP-10, 100 East 42nd Street, New York 17, N. Y.
Factories in Dobbs Ferry, N. Y.; Mount Vernon, N. Y. (Metalix Div.); Lewiston, Me. (Elmet Div.)

Outstanding Personalities of the Wire Industry

Thomas Sheppard Ingham

BORN in Stockbridge, Massachusetts, February 22, 1893, the only son of Dr. Lucius T. and Julia C. Sheppard Ingham.

✦ ✦ ✦

HIS early education was received in the public schools of West Stockbridge and Lee, Massachusetts, graduating from the Lee High School in 1911. He also attended Drexel Institute, Philadelphia, specializing in engineering.

✦ ✦ ✦

HE enlisted in the U. S. Army at the outbreak of World War I and attended O.T.C. at Fort Niagara, New York and received his commission. War ended before he was sent overseas.

THOMAS SHEPPARD INGHAM

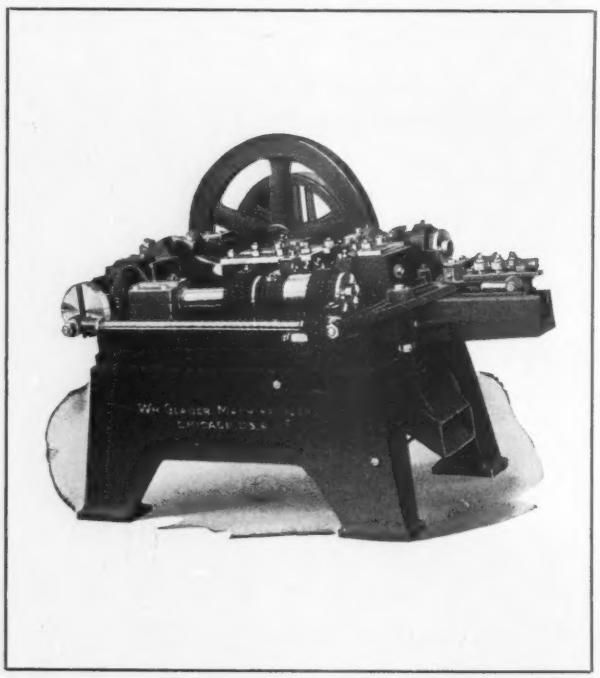
IN 1918 he married Marie K. Ritz, daughter of Mr. and Mrs. Frederick, Ritz, of Newark, Delaware.

FOLLOWING an honorable discharge from the Army, he was associated for a short time with R. E. Crank & Company, Philadelphia, and later with Edw. G. Budd Manufacturing Company, Philadelphia. In 1925 he became associated with the American Chemical Paint Company, Ambler, Pennsylvania, where he remained until his death of a heart attack in New York City, August 14, 1944.

✦ ✦ ✦

TOM INGHAM is survived by his wife and son, 2nd Lieutenant Frederick L. Ingham, now stationed at Fort George G. Meade, Maryland, and a sister, Mrs. Floyd Y. Parsons. Another son, 1st Lieutenant Thomas S. Ingham, Jr., A. A. F., has been reported missing over Burma since 1943.

GLADER HIGH SPEED WIRE NAIL MACHINE



High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS

210 NO. RACINE AVE.
CHICAGO, ILLINOIS

TOM INGHAM has long enjoyed the friendship of men in the wire industry, where his loss is keenly felt.

✦ ✦ ✦

Raleigh H. Barnes

Raleigh H. Barnes, 46, assistant director of research of the American Steel & Wire Co., died suddenly Saturday afternoon, September 2, after collapsing after a golf game at the Willowick Country Club.

✦ ✦ ✦

MR. BARNES first worked for the American Steel & Wire Co., when he was hired as a laboratory assistant in 1920 at the Newburgh Steel Works. He held various positions at that plant and at the Cuyahoga Works in Cleveland before being transferred to the Cleveland district manager's office in March, 1937, as assistant district metallurgist. In October of the same year, he was made district metallurgist and in February, 1939, he was appointed division metallurgist in the metallurgical department, which position he held until he was appointed assistant director of research in May, 1944.

✦ ✦ ✦

George R. Brown

George R. Brown, superintendent of manufacturing engineering at Western Electric Company's plant at Kearny, N. J., died Sept. 7, after suffering a heart attack.

✦ ✦ ✦

HE moved to Kearny in 1929 as assistant superintendent in charge of inspection methods, having joined the company seven years earlier as engineer inspector in Chicago. Previously he headed the physics and chemistry department of Frankfort High School in Frankfort, Ind., where he was born. He studied engineering at Earlham College in Indiana, graduating in 1920.

✦ ✦ ✦

Wickwire Spencer Announces Operating Personnel Changes

THE Wickwire Spencer Steel Company has announced three important changes in its plant operating personnel. **Mr. M. G. Werme,** formerly Superintendent at the Clinton, Massachusetts plant, has been appointed Chief Development Engineer of the Company. **Mr. Gordon Lloyd,** has been appointed Superintendent at the Clinton Plant. **Mr. Victor Chartner** has been appointed Chief Mechanical Engineer of Wickwire Spencer.

✦ ✦ ✦

MR. WERME has been associated with Wickwire Spencer for the past twenty-five years, nineteen at the Clinton plant. He was appointed Superintendent there in 1935. In his new post it is expected that his outstanding record as Operating Engineer will be of inestimable value. Mr. Werme will make his headquarters at the Buffalo plant.

✦ ✦ ✦

MR. LLOYD, was formerly Power and Fuel Engineer for the Carnegie Illinois Steel Corpor-

(Please turn to Page 716)

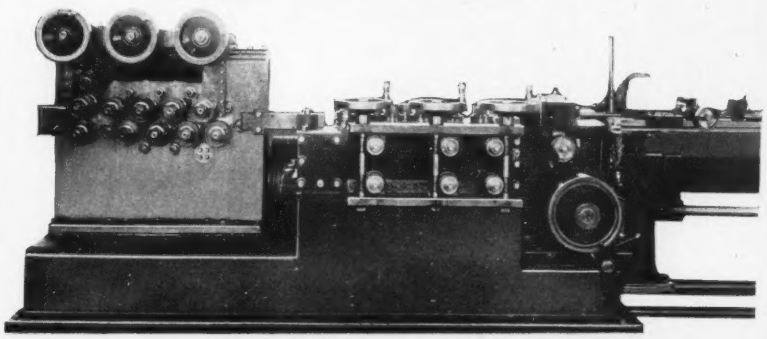
AUTOMATIC STRAIGHTENING AND CUTTING MACHINES

equipped with

FLYING SHEAR

for

Round and Shaped Rods and Wire



Will produce uniform quality material without marking. High production, with accurate lengths.

THE HALLDEN MACHINE CO.

THOMASTON, CONNECTICUT

Outstanding Personalities of the Wire Industry

(Continued from Page 715)

ation, and Chief Engineer of the Loftus Engineering Corporation, Pittsburgh.

✦ ✦ ✦

MR. VICTOR CHARTNER was previously with the Pittsburgh Steel Company, since 1930 as Chief Engineer. His long record in the steel industry includes in addition, service with the Otis Steel Company of Cleveland, the Pittsburgh Crucible Steel Company of Midland, Pa., the Benson Mines Company of New York and the Jones and Laughlin Steel Company. Mr. Chartner will make his headquarters at Buffalo.

✦ ✦ ✦

Earl J. Senne, Sales Manager, Spring Division, The Cleveland Wire Spring Company

MR. EARL J. SENNE has been appointed as Sales Manager

VICTOR CHARTNER
Chief Mechanical Engineer,
Wickwire Spencer Steel Co.

of the Spring Division of The Cleveland Wire Spring Company, effective September 1st. Mr. Senne has served in a sales capacity with this company since 1910, with the exception of service with the Intelligence Division of the U. S. Army during World War 1. Mr. Senne is well known throughout the automotive and aviation industries, to which the Company is devoting one hundred per cent of its production facilities during World War II.

✦ ✦ ✦

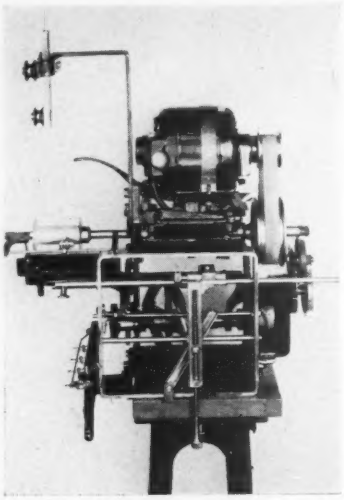
THE Company has announced the retirement of **Mr. Joseph F. Ursem,** who has been with the Company continuously since 1896, and since 1903 as Sales Manager of the Spring Division. During his 48 years in the spring industry, Mr. Ursem has made a wide acquaintance among the veterans of the early automotive industry.

✦ ✦ ✦

Hubert Glatte, Appointed District Engineer, Industrial Oven Engineering Co.

HUBERT GLATTE of Buffalo former assistant purchasing agent for the National Gypsum Company, has been appointed district engineer for the Industrial Oven Engineering Company of Cleveland, and will cover the West-

STANDARD UNI-DRIVE WIRE WINDER



Patent No. 2,223,155

Increase your production with this winder. Incorporates many valuable new features. Winds up to 10 ends on each spool. New micrometer variable traverse motion winds evenly between heads. No more hollow shaped spools or bunching of wire next to heads. Geared wind produces straight parallel wind which eliminates jumping of guide on braider latch. Starts slow. Makes possible greatly increased production.

Main drive belts done away with. Traverse variation from 1/2" to 6" between heads without changing cam. Equipped with 1/4 H.P. A.C. motor for 110 volts, 60 cycle current, single phase.

Over 300 of these winders in successful operation. You should have full information on this winder in your files. Please write to nearest office for particulars.

STANDARD MILL SUPPLY CO.

P. O. BOX 1534, PROVIDENCE, R. I.

Plant and Offices: 1064 - 1090 Main St., Pawtucket, R. I.

Southern Office: Southern Standard Mill Supply Co., 512 W. 4th St., Charlotte, N. C.

New York Office: 1022 Empire State Bldg., 350 Fifth Ave., New York, N. Y.

ern New York territory for this firm.

✦ ✦ ✦

MR. Glatte has previously been employed in various engineering capacities by the Turner Construction Company, the Associated Buffalo Architects and the Buffalo Board of Education. In 1937 he went to National Gypsum, where he remained until he accepted his present position with Industrial Oven.

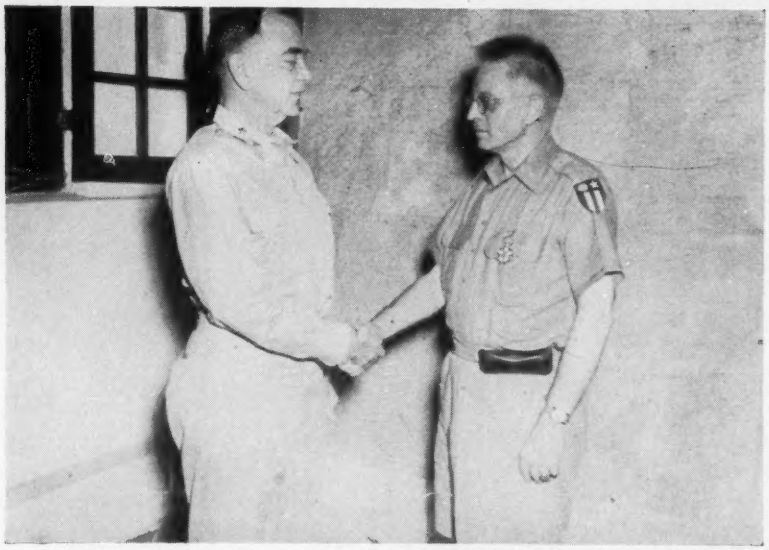
✦ ✦ ✦

Robert E. Lewis, President, Cleveland Wire Spring Co., Cleveland, Ohio

ROBERT E. LEWIS has resigned his position as treasurer of the American Steel & Wire Company, subsidiary of U. S. Steel Corporation. He has been elected president of the Cleveland Wire Spring Company, located in Cleveland. His resignation from the Wire company became effective September 1st.

(Please turn to Page 718)

Legion of Merit Awarded to Colonel Frank W. Bullock, Signal Corps, United States Army



"For exceptionally meritorious conduct in the performance of outstanding services," Col. Frank Willard Bullock (right) has been awarded the Army's Legion of Merit Medal. The presentation was made at New Delhi, India, by Maj. Gen. Dan I. Sultan, Deputy Commander of the China-Burma-India Sector. General Sultan is shown here congratulating Colonel Bullock after making the award. Colonel Bullock directed the procurement section of the Signal Corps from September, 1939, to March, 1942. ✦ ✦ ✦ ✦ ✦ ✦

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"NEP" and "SUMFOAM"

"Those perfect partners for pickling"

Use "NEP" acid inhibitor to save steel and acid, and to reduce hydrogen embrittlement.

Use "SUMFOAM" pickling compound to prevent fumes generated in pickling.

Samples of each on request.

THE WILLIAM M. PARKIN CO.

Chemical Engineers

1102 HIGHLAND BLDG. PITTSBURGH 6, PA.

Outstanding Personalities of the Wire Industry

(Continued from Page 717)

MR. Lewis held various credit and accounting posts in the East and practiced as a certified public accountant in New York State before becoming assistant director of banking and cashiering of the New York World's Fair in 1939. He subsequently was appointed comptroller of the advertising agency, Batten, Barten, Durstine & Osborne. In September, 1941, he was made assistant to the treasurer of the American Steel & Wire Company and the following May he was elected treasurer.

✦ ✦ ✦

W. F. Knoll, Manager, Trenton Steel Works, Trenton, N. S.

W. F. KNOLL, of Trenton, N. J., for the past six months the acting manager of the Trenton Steel Works, Trenton, has been appointed manager, succeeding **O. P. Stensrud**, who retired because of ill health. Mr. Knoll had been deputy controller of wire, nail and rod products, for Canada under the wartime controls, and with base at Ottawa, Ont. Previously, he had been superintendent of James Pender Company, St. John, nail manufacturers for many years. He had been with the Pender firm about 20 years as draftsman, assistant superintendent and superintendent. Prior to that with the Dominion Steel Corporation, at Sydney, N. S.

✦ ✦ ✦

Charles R. Hook, Jr., Asst. to Vice-President, Rustless Iron & Steel Corp.

CHARLES R. HOOK, JR., has been elected secretary and also assistant to the vice-president and general manager, Rustless Iron & Steel Corp., Baltimore, Md. He joined the company in 1937 and since 1942 has been assistant to the president.

✦ ✦ ✦

Robert L. Irvin, Works Manager, Graham Plant, Pittsburgh Screw & Bolt Co.

ROBERT L. IRVIN has been appointed works manager of the Graham Plant, Pittsburgh Screw & Bolt Corp. **George H. Lee, Sr.**, former works manager of the Graham Plant, will now devote his entire time to experimental and advisory work for all the plants of the corporation.

✦ ✦ ✦

Lovejoy Heads Riehle's Kansas City Sales District

Frederick K. Lovejoy has been appointed manager of its Kansas City district sales territory by American Machine and Metals, Inc., East Moline, Illinois, with offices in the Midland Building.

To the members of the Wire Association, we wish to extend
CONVENTION GREETINGS
and earnestly hope you will enjoy the program.
With plants now operating in Chicago, Illinois, and Garrett, Indiana, the Hubbard organization is better able than ever before to serve you in your requirements for spools, reels and traverses.
ARMY
NAVY
HUBBARD SPOOL COMPANY
1624 CARROLL AVENUE | CHICAGO 12, ILLINOIS
Since 1912, manufacturers of wire drawing and annealing, and shipping spools and reels.
PLANTS AT CHICAGO, ILLINOIS AND GARRETT, INDIANA

Join The Wire Association
Annual Dues $10.00

Wire Association Membership List

(Continued from Page 701)

CRUM, E. JEFFERSON, Foreman,
Wire & Rod Div.,
Bethlehem Steel Company,
Sparrows Point 19, Maryland

CUNY, COL. C. D., Signal Corps,
U. S. Army,
c/o War Department,
Washington, D. C.

DARRAH, W. A., President,
Continental Industrial Engineers, Inc.,
Chicago 3, Illinois

DAVIES, EDW. J., Gen'l Supt.,
Driver Harris Co.,
Harrison, N. J.

DAVIS, BENJAMIN H., Sales Engr.,
John Royle & Sons,
Paterson 3, New Jersey

DAVIS, K. H., President,
K. H. Davis Wire & Cable Corp.,
Los Angeles 11, Calif.

DAVIS, RALPH L., President,
R. L. Davis Electric Company,
Wallingford, Conn.

DAY, JAMES, Director,
James Day (Machinery) Ltd.,
London, W.1, England

DeKLYN, JOHN H., Supt.,
U. S. Aluminum Company,
Massena, New York

DENIS, A. J., Chief Tool Engr.,
Carbide Tool Mfg. Company,
Los Angeles 46, California

DERN, EMIL, Secretary,
Kelly Wire Die Company,
New York, N. Y.

DesCOMBES, L. E., Supv., Wire & Springs Oprs.,
International Harvester Company,
Rock Falls Works,
Rock Falls, Ill.

DILLON, W. M., Asst. Secy.,
Northwestern Steel & Wire Company,
Sterling, Illinois

DIMLING, PAUL E., Firthaloy Repr.,
Firth-Sterling Steel Co.,
Cleveland, Ohio

DOBRIN, HARRY, Vice President,
Furnace Engineers, Inc.,
Pittsburgh, Pa.

DONACHIE, MATTHEW J.,
Beryllium Corp. of Pa.,
Reading, Pa.

DONALD, GEO. E., Supt.,
Donald Ropes & Wire Cloth Co., Ltd.,
Hamilton, Ont., Canada

DONOVAN, D. R., Vice-Pres.,
Callite-Tungsten Corp.,
Union City, N. J.

DONOVAN, GORDON I., Supt.,
Volco Brass & Copper Co., Inc.,
Kenilworth, New Jersey

DOYLE, J. A., Vice President,
The W. S. Rockwell Company,
New York 7, N. Y.

DRAKE, LYNN H., Wire & Cable Engr.,
War Department, Facilities Branch,
Office of the Chief Signal Officer,
Arlington, Va.

DRIVER, ROBERT O., Vice Pres.,
Wilbur B. Driver Company,
Newark 4, New Jersey

DRIVER, WALTER, Engr.,
South African Iron & Steel Industrial
Corp., Ltd., Iscor Works,
Pretoria, South Africa

DULL, T. B., Supt. of Oprs.,
Wire Mills,
Sheffeld Steel Corporation,
Kansas City 3, Missouri

DUNLAP, R. T., Vice-Pres. Chg. Prod.,
Wickwire-Spencer Steel Co.,
Buffalo, N. Y.

DURST, GEO., Metallurgist,
General Plate Company,
Attleboro, Mass.

EARHART, OWEN, Gen. Sales Mgr.,
Fidelity Machine Company,
Philadelphia 24, Pa.

EARLY, E. F., Dist. Mgr.,
Wickwire Spencer Steel Co.,
Morgan Works,
Worcester 6, Mass.

EASTLAKE, WM. H., Asst. Gen. Supt.,
Northern Electric Company, Ltd.,
Montreal, P. Q., Canada

EATON, R. M., Resident Mgr.,
Hazard Insulated Wire Works,
Wilkes-Barre, Pa.

EDINGA, H. P., Factory Mgr.,
Wire Div.,
North American Phillips Co., Inc.,
Dobbs Ferry, New York

ELDER, FLINT C., Special Research Engr.,
American Steel & Wire Company,
Cleveland 13, Ohio

ELLAMS, RALPH C., Supv., Elec. Coat. Devl.,
Roxalin Flexible Finishes, Inc.,
Elizabeth "F", New Jersey

ELLIOTT, H. A., Plant Mgr.,
Essex Wire Corporation,
Detroit 3, Michigan

EMIG, FRED J., Chemist,
Finishes Div.,
E. I. DuPont de Nemours Co., Inc.,
Chicago 14, Ill.

ENGELHART, F. C.,
Kester Solder Company,
Chicago 39, Illinois

ENGMAN, ALFRED,
Queens Village, L. I., N. Y.

ENTWISTLE, JAMES L.,
Pawtucket, Rhode Island

ESPOSITO, RALPH, Dist. Repr.,
Vascoloy Ramet Corporation,
Pittsburgh, Pa.

EVANS, W. J., Supt.,
Rotary Elec. Steel Co.,
Detroit 20, Mich.

FANTONE, CHARLES B., President,
Syncro Machine Company,
Perth Amboy, N. J.

FARNSWORTH, W. B., Chief Met.,
Pittsburgh Steel Company,
Monessen, Pa.

FAST, PAUL R., Genl. Mgr.,
Vascoloy Ramet Corp.,
Jersey City 6, N. J.

FERGUSON, D. H., Fabricating Supt.,
Aluminum Co. of Canada, Ltd.,
Shawinigan Falls, P.Q., Canada

FINDLEY, J. K., Metallurgist,
Allegheny Ludlum Steel Co.,
Dunkirk, New York

FIRTH, F., Managing Director,
Overend & Company, Ltd.,
Leeds, 10, Yorks., England

FIRTH, L. GERALD, President & Gen. Mgr.,
Firth-Sterling Steel Co.,
McKeesport, Pa.

FISHER, E. J. P.,
North Jackson, Ohio

(Please turn to Page 720)

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WIRE DRAWING

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(Continued from Page 719)

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International Radio Pty. Co., Ltd.,
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FOSBURG, HILDOR A., Secretary,
The Meaker Company,
Cicero 50, Chicago, Illinois
FOSS, DR. ING. F. F., Dir. Res. & Met.,
Wheeling Steel Corp.,
Wheeling, W. Va.
FOUKAL, A., Manager, Misc. Steel Prod. Div.,
Truscon Steel Company,
Cleveland 4, Ohio
FRASER, JOHN G., Mgr.,
The Northern Bolt Screw & Wire Co., Ltd.,
Owen Sound, Ont., Canada
FRASOR, J. R., Chief Inspector,
Northwestern Steel & Wire Co.,
Sterling, Illinois
FRIEDMAN, J. H., Vice President,
National Machinery Company,
Tiffin, Ohio
FROMMANN, M. H., Gen. Supt.,
Townsend Company,
New Brighton, Pa.
FRY, L. S., Works Mgr.,
Joslyn Mfg. & Supply Co.,
Fort Wayne 6, Indiana
GAINES, FREDERICK W., 3rd. Mech. Engr.,
Ajax Manufacturing Company,
Euclid 17, Ohio
GALLT, S. B., Asst. Dist. Supt.,
Crucible Steel Co. of America,
Syracuse 1, N. Y.
GALLOWAY, JAMES W., Plant Engineer,
B. Greening Wire Co., Ltd.,
Hamilton, Ont., Canada
GARRATT, FRANK, Supt. Cold Process Dept.,
Universal Cyclops Steel Corp.,
Bridgeville, Pa.
GARRETT, C. W., Wire Mill Met.,
Jones & Laughlin Steel Corp.,
Aliquippa, Pa.
GASTON, ROY G., Gen. Foreman,
Bethlehem Steel Company,
Johnstown, Pa.
GERBER, J. P., Plant Supt.,
The Electric Auto-Lite Co., Wire Div.,
Port Huron, Michigan
GIBBS, C. R.,
Wickwire Spencer Steel Co.,
Mt. Wolf, Pa.
GLADER, FRANK J., President,
Wm. Glader Machine Works,
Chicago 7, Illinois
GLASER, E. S., Supt.,
National Drawn Steel Co., Inc.,
E. Liverpool, Ohio
GLEN, A. E., Sales Engr.,
Asst. to V. P. Chg. Sales,
Carboloy Company, Inc.,
Detroit 32, Michigan
GORDON, C. S., Wire Devl. Engr.,
Bell Telephone Laboratories, Inc.,
Murray Hill, N. J.
GORE, JAMES, Supt. Cold Drawing Dept.,
Atlas Steels, Ltd.,
Welland, Canada
GRANGER, L. D., Asst. to V. P.,
Wickwire Spencer Metallurgical Corp.,
Newark, N. J.
GRASSELL, P. W., Pres. & Treas.,
Wilson Steel & Wire Co.,
Chicago 9, Illinois
GUNDSTROM, E. W., Asst. Plant Mgr.,
Rome Cable Corp.,
Rome, New York
GUSCOTT, LOWELL E., Supt.,
United Screw & Bolt Corp.,
Cleveland, Ohio
GUTHMAN, EDWIN I., President,
Edwin I. Guthman & Co., Inc.,
Chicago 7, Ill.
GUTTENTAG, S. WM., Pres.,
Franklin Steel & Wire Co., Inc.,
Brooklyn 15, N. Y.
HAARBAUER, H. W.,
New Brighton, Pa.
HABIG, WM. E., Sales Engr.,
Sperry Products Co.,
Hoboken, N. J.
HAGUE, JOSEPH A., Dist. Sales Mgr.,
Pittsburgh Steel Co.,
Cleveland, Ohio
HALL, B. W., Sales Engr.,
Carboloy Company, Inc.,
Agawam, Mass.
HALL, C. E., Asst. Plant Mgr.,
National Lead Co.,
Barber, N. J.
HALL, EDWARD P., Met.,
Kennecott Wire & Cable Co.,
Phillipsdale, Rhode Island
HALLBERG, RAYMOND O., Supt. Cold Mill,
Wilbur B. Driver Co.,
Newark 4, N. J.
HALLWORTH, J. G., Secy.,
The Niagara Wire Weaving Co.,
Niagara Falls, Canada
HAMAKER, R. L., Dist. Sales Mgr.,
Warner Company,
New York 20, N. Y.
HAMMITT, S. J., Mgr.,
Morrison Steel & Wire Co., Ltd.,
Vancouver, B. C., Canada
HANNON, C. H., Metallurgist,
Works Laboratory,
General Electric Company,
Pittsfield, Mass.
HARMON, CHAS. D., Sales Engr.,
National Machinery Company,
Tiffin, Ohio
HARRIS, FRANCIS A., President,
F. A. Harris, Inc.,
Springfield 3, Mass.
HARRISON, CHAS. E., Gen. Sales Mgr.,
Wire & Screw Products Div.,
Canada Works,
Steel Co. of Canada, Ltd.,
Hamilton, Ont., Canada
HARRISON, N. C., Vice President,
Atlantic Steel Company,
Atlanta 1, Georgia
HARTLEY, GEORGE D., Consultant,
Worcester 2, Mass.
HARTMANN, E. G., Sales Mgr.,
Round Flat Wire & Spec. Div.,
John A. Roebling's Sons Co.,
Trenton 2, New Jersey
HARTWELL, RALF L., Asst. to Pres.,
Metal Textile Corp.,
West Orange, New Jersey
HAUGER, FLOYD M., Vice President,
Standard Industrial Compounds Co.,
Chicago 44, Illinois
HAWLEY, JOHN S., Supt.,
California Wire Cloth Corp.,
Oakland 4, Calif.
HAYNES, S. L., SR., Gen. Supt.,
Carter Traveler Div.,
A. B. Carter, Inc.,
Gastonia, North Carolina
HEIL, CARL E., Gen. Mgr.,
Heil Engineering Company,
Cleveland, Ohio
HENDERSON, KEITH T., Metallurgist,
Broken Hill Proprietary Co., Ltd.,
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Newcastle, N.S.W., Australia
HERSCHBERGER, F. B.,
Industrial Sales Wire Dept.,
Sheffield Steel Corp.,
Kansas City 3, Mo.

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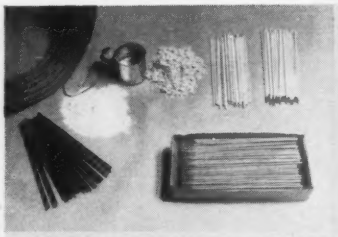
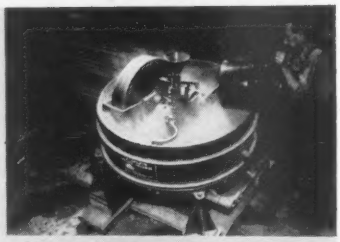

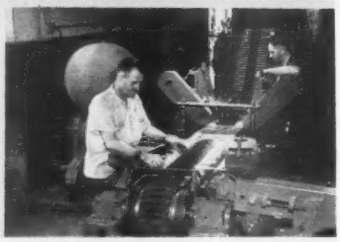

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Surface Combustion,
Div. of General Properties Co., Inc.,
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HILL, H. W., Gen. Supt.,
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Sterling, Illinois

HIRE, HARRY E., Supt. Wire & Insulation Div.,
General Electric Company,
Fort Wayne 2, Indiana

HITCHCOCK, WM. E., President,
Atlantic Wire Company,
Branford, Conn.

HOLCOMBE, ALBERT S., Mgr.,
Neil C. Potter Co.,
Newark, N. J.

HOLMQUIST, C. W., Gen. Wks. Mgr.,
Copperweld Steel Co.,
Glassport, Pa.

HOLMQUIST, JOHN A.,
Aliquippa, Pa.

HOLTON, A. E., President,
Essex Wire Corporation,
Detroit 3, Michigan

HOPKINS, H. L., Metallurgist,
National Screw & Mfg. Company,
Cleveland 4, Ohio

HOPKINS, J. E., Secy.-Treas.,
Marshall Specialty Co., Ltd.,
Toronto 1, Ont., Canada

HORN, GEORGE B., Gen. Supt.,
The Wheeler Insulated Wire Co.,
Bridgeport, Conn.

HORN, ROBERT S., JR., Vice Pres.,
Hans C. Bick, Inc.,
Reading, Pa.

HORNBROOK, F. L., Asst. Sales Mgr.,
Wire Division,
Continental Steel Corp.,
Kokomo, Indiana

HORSFALL, D.,
c/o Canada Wire & Cable Co., Ltd.,
Toronto, Ontario, Canada

HORSFALL, HERBERT, Pres. & Manag. Dir.,
Canada Wire & Cable Co., Ltd.,
Toronto, Ont., Canada

HORSFALL, LIEUT. COL. J. H. C., Director,
Latch & Batchelor, Ltd.,
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HOSKINSON, FLOYD J., Supt. Cold Drawn,
Copperweld Steel Company,
Warren, Ohio

HUBBARD, E. J., President,
Hubbard Spool Company,
Chicago 12, Illinois

HUGHES, CHARLES E., Sales Engr.,
Firth-Sterling Steel Co.,
Culver, Indiana

HUGHES, WILFRED A., Gen. Foreman,
Gilbert & Bennett Mfg. Company,
Georgetown, Conn.

HUME, W. G., Vice President,
Reynolds Wire Company,
Dixon, Illinois

HUSSEY, R. M., Supt. Wire Dept.,
Jones & Laughlin Steel Corp.,
Aliquippa, Pa.

IGOE, PETER, Treasurer,
Igoe Brothers, Inc.,
Newark 5, New Jersey

IHRIG, DR. HARRY K., Dir. of Labs.,
Globe Steel Tubes Co.,
Milwaukee 4, Wis.

INGHAM, T. S., Asst. Sales Mgr.,
American Chemical Paint Co.,
Ambler, Pa.

IREDELL, C. V.,
Westinghouse Elec. & Mfg. Co.,
Westinghouse Lamp Div.,
Bloomfield, New Jersey

IRELAND, D. B., Secy.-Treas.,
Wolverine Bolt Company,
Detroit 13, Michigan

IRWIN, COL. G. A.,
c/o War Department,
Washington, D. C.

JACKMAN, ALAN, Firthaloy Div.,
Firth-Sterling Steel Co.,
Chicago 6, Illinois

JACKSON, REGINALD H., Pres. & Gen. Mgr.,
Canadian Elevator Equipment Co., Ltd.,
Toronto 2, Ont., Canada

JAGIELSKI, OTTO F., Designing Engr.,
Heald Machine Company,
Worcester 2, Mass.

JEFFRIES, JAMES, Asst. Mgr.,
Driscoll Wire Company,
Shelton, Conn.

JENKS, FRANK, Production Supt.,
Rylands Brothers (Australia) Ltd.,
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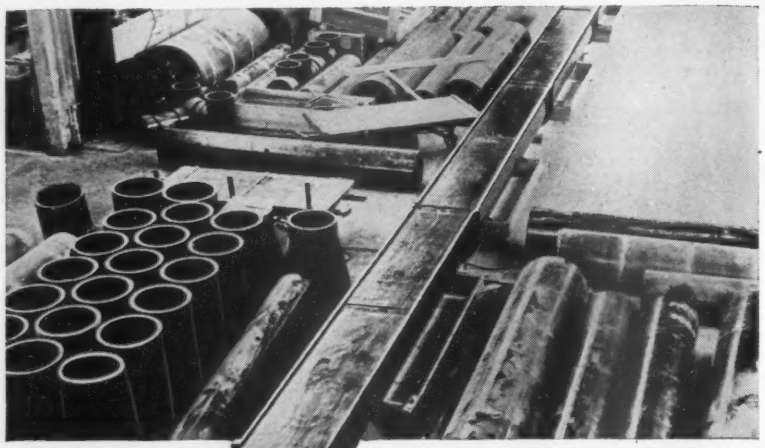

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SLIFKA, M., Pur. Agt.,
Parker-Kalon Corporation,
New York 14, N. Y.

SMIGEL, WALTER A., Chem. Ind. Engr.,
Cleveland 20, Ohio
(Repr. R. H. Miller Co., Inc.)

SMITH, C. J. S.,
Smith Brothers,
Birmingham, England

SMITH, H. H., Asst. Mgr. Met. Dept.,
American Steel & Wire Co.,
Cleveland 13, Ohio

SMITH, JAMES A., Asst. Gen. Supt.,
Copperweld Steel Company,
Glassport, Pa.

SMITH, J. GODFREY, President,
Federal Wire & Cable Co., Ltd.,
Guelph, Ontario, Canada

SMITH, JOHN M., Gen. Foreman,
John A. Roebling's Sons Co.,
Roebling, N. J.

SMITH, REED R., Mgr. Sales.,
Master Wire Die Corp.,
New York 17, N. Y.

SMITH, VanDORN C., Sales Dept.,
Oakite Products, Inc.,
New York 6, N. Y.

SMITH, W. M.,
Wickwire Spencer Steel Co.,
Chicago 1, Illinois

SOMERS, J. L., Vice Pres.,
Texas Nail & Wire Co.,
Galveston, Texas

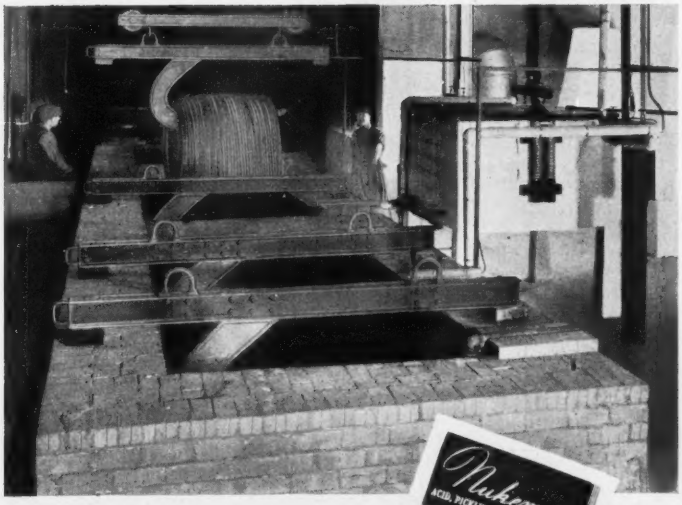
(Please Turn to Page 726)

11 Years Service FOR THIS NUKEM ACID TANK

—a lasting and permanent investment!

This 3-section wire pickling tank was installed for Russell, Burdsall & Ward Bolt & Nut Company, Rock Falls, Ill., in October, 1933. It is 35 ft. long x 6 ft. wide x 7 ft. deep and constructed of reinforced concrete with concrete partitions. The inside was lined with double brick BASOLIT to insure clean and spotless pickling and years of freedom from deterioration and repairs. The record shows that it is doing exactly what it was designed to do.

Write for illustrated literature describing BASOLIT Pickling Tank Construction and its advantages in your plant. If desired, we will furnish the labor as well as the materials on any installation.



Nukem

NUKEM PRODUCTS CORPORATION, Buffalo 2, New York

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New York Detroit Pittsburgh Chicago Steubenville, Ohio Kitchener, Ont.

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Los Angeles - Niles - San Francisco, Calif.
Portland, Ore. Seattle, Wash.

Southwest Representatives
ELGIN BUTLER BRICK CO.
Austin - Dallas - Houston, Texas

Wire Association Membership List

(Continued from Page 725)

SOMERVILLE, W. E., President,
W. E. Somerville Company,
Coal City, Illinois

SOMMER, D. P., Vice Pres. & Gen. Supt.,
Keystone Steel & Wire Co.,
Peoria 7, Illinois

SOMMER, LESTER B., Asst. to Pres.,
Mid-States Steel & Wire Co.,
Crawfordsville, Indiana

SOMMER, W. B., Firthaloy Engr.,
Firth-Sterling Steel Co.,
Evanston 2, Illinois

SOMMERFELD, K. J. & A.,
Constructional Engineers,
Cowley, Middlesex, England

SPALDING, L., Wks. Mgr. & Dir.,
Hipprum Wires, Ltd.,
Hipperholme, Halifax, England

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Spargo Wire Company,
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SPEAR, EMERSON, Vice Pres.,
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SPELLMAN, R. W., Dist. Repr.,
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West Hartford 7, Conn.

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Washington, D. C.
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New York, N. Y.)

SPRUANCE, F. P., Vice President,
American Chemical Paint Co.,
Ambler, Pa.

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Firthaloy Div.,
Firth-Sterling Steel Co.,
McKeesport, Pa.

STEVICK, R. S., Works Mgr.,
Firth-Sterling Steel Co.,
McKeesport, Pa.

STICKNEY, F. S., Vice Pres. & Ch. Engr.,
Instrument Specialties Company,
Little Falls, New Jersey

STIER, GEO. G., Asst. Sales Mgr.,
National Oil Products Co.,
Specialties Div.,
Harrison, New Jersey

STIRLING, A. B., Secy.,
Greening Wire Co., Ltd.,
Britannia Works,
Warrington, England

STUMPF, GORDON A., Met. Research Dept.,
Timken Roller Bearing Co.,
No. Canton, Ohio

SULLIVAN, F. W., Treas.,
Grief Bros. Cooperage Co.,
Cleveland 13, Ohio

SULLIVAN, J. J.,
Pittsburgh 16, Pa.

SUNDERLAND, C. C., Chief Engr.,
John A. Roebling's Sons Co.,
Trenton 2, N. J.

SWIFT, JOHN WILLIAM, Fabricating Supt.,
Aluminum Co. of Canada, Ltd.,
Shawinigan Falls, P.Q., Canada

TATNALL, RODMAN R., Met. Engr.,
Wickwire Spencer Steel Co.,
Morgan Works,
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Ekstrand & Tholand, Inc.,
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THOMAS, EARLE H., Supt.,
Geo. W. Prentiss & Co.,
Holyoke, Mass.

THOMPSON, J. D., Wks. Mgr.,
John A. Roebling's Sons Co.,
Trenton 2, N. J.

THOMPSON, J. R., Mgr. Met. Dept.,
American Steel & Wire Co.,
Cleveland 13, Ohio

TIMBERLAKE, J. E., Mgr. Wire Sales,
Jones & Laughlin Steel Corp.,
Pittsburgh 30, Pa.

TIMMERMAN, E. D.,
Steel Co. of Canada, Ltd.,
Montreal, P.Q., Canada

TREMBICKI, HAROLD L., Wire Mill Repr.,
Magnus Chemical Company,
Cleveland, Ohio

TROSS, E. E., Wks. Mgr.,
Columbus Bolt Works,
Columbus, Ohio

TWIBLE, W. J., Gen. Mgr.,
Graham Nail & Wire Products Ltd.,
Toronto 1, Ont., Canada

ULLMANN, LEO,
21 Manor Way,
Chesham, Bucks, England

ULLRICH, FREDK. GEO., Gen. Mgr.,
N. Z. Fence & Gate Works,
Petone, New Zealand

ULLRICH, HENRY F., Asst. Supt.,
John A. Roebling's Sons Co.,
Trenton 2, New Jersey

UNITED WIRE WORKS, LTD.,
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UPDIKE, F. TITUS, Engr.,
John A. Roebling's Sons Co.,
Trenton 2, N. J.

VanHOOK, CHARLES F., Mgr.,
Cable & Machinery Div. & Ch. Engr.,
Watson Machine Company,
Paterson, New Jersey

vanSTRATEN, J. C., Secy.,
Anton Smit & Co., Inc.,
New York 19, N. Y.

VanVALKENBERG, F. S., Engr.,
Chg. Wire Drawing Mach. Div.,
Waterbury Farrel Fdry. & Mach. Co.,
Waterbury 86, Conn.

VAUGHN, L. A., President,
Vaughn Machinery Company,
Cuyahoga Falls, Ohio

VERSCHLEISER, J. H., Sales Mgr.,
Wire Products,
Laclede Steel Company,
St. Louis 1, Missouri

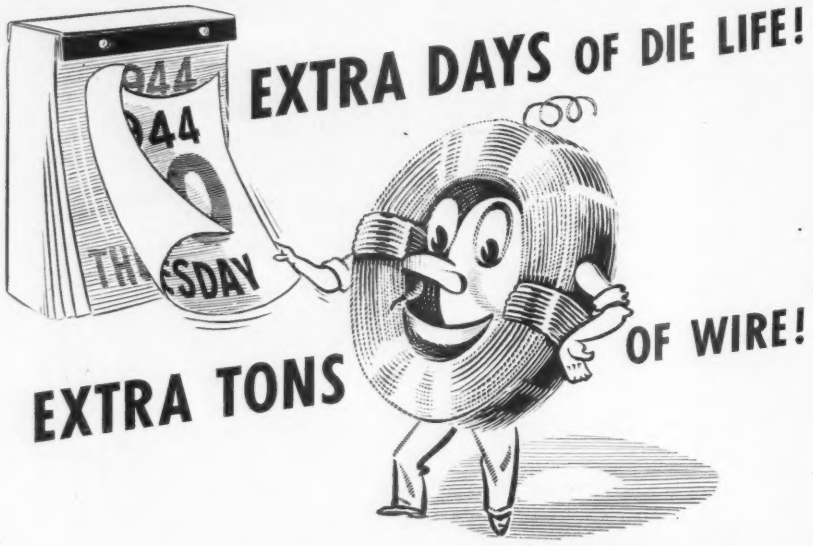
VIRDEN, C. L., Supt.,
Reid-Avery Company,
Dundalk, Baltimore 22, Maryland

VOIGTLANDER, CURTIS, Supt.,
Wire Mills,
Union Wire Rope Co.,
Kansas City 3, Missouri

WAARICH, O. W., Gen. Supt.,
Pheoll Manufacturing Company,
Chicago 50, Illinois

WAGNER, R. J., Met.,
Central Screw Company,
Chicago, Illinois

WARBRICK, JAMES H., Sales Engr.,
James Day (Machinery) Ltd.,
London, W. 1, England



Every minute of extra working life you get with TECO Carbide Dies, ticks off greater tonnage. You get more productive time from your machines because you waste less time for die changes.

TECO Cemented Carbide stays on the job longer because it is harder, denser, more uniform — therefore more resistant to wear and friction.

Let a test run prove how TECO Carbide Dies can improve your production — in speed, in accuracy, in smoothly-finished tonnage. Our engineers are glad to discuss your needs.

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Branch Office: 2906 Euclid Ave., Cleveland, Ohio
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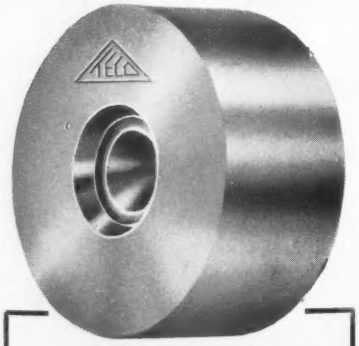

WIRE and BAR DIES
EXTRUDING DIES
TUBING DIES • SIZING DIES
Also Carbide Blanks, Tools, Bits, Reamers and Forming Tools

TECO Pioneers in Tungsten Carbides for over a Quarter Century **CARBIDE DIES**

WARD, C. T., Supt. Rod & Wire Mills,
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Johnstown, Pa.
WARNER, CHARLES M., Supt. Wire Mill,
Scovil Manufacturing Co.,
Waterbury, Conn.
WATKINS, STANLEY P., Mgr. Sales Devl.,
Rustless Iron & Steel Corp.,
Baltimore 13, Md.
WEBB, E. H., President,
Webb Wire Works,
New Brunswick, New Jersey
WEBER, ELMER C., Die Design.,
Firth-Sterling Steel Co.,
McKeesport, Pa.
WEIKEL, G. A., Sales Engr.,
American Chemical Paint Co.,
WEIL, A., Supt. Metal Div.,
National Lead Co.,
Ambler, Pa.
Barber, N. J.
WEILL-QUILLARDET, LEON, Consultant,
National Lead Co.,
Jersey Steel & Wire Corp.,
New York, N. Y.
WEINMANN, E. R., Sales Mgr.,
Nukem Products Corporation,
New York, N. Y.
WELLINGS, CAPTAIN A. J., U.S.N.,
Alexandria, Virginia
WEINMANN, E. R., Sales Mgr.,
Nukem Products Corp.,
New York 18, N. Y.
WEISER, P. W., Dist. Mgr.,
Carboloy Company, Inc.,
Pittsburgh 19, Pa.
WELSH, J. ALAN,
Upper Darby, Pa.
WERME, M. G., Plant Supt.,
Wickwire Spencer Steel Co.,
Clinton, Mass.
WESSEL, E., Vice President,
Beall Tool Company,
East Alton, Illinois
WESTPHAL, LT. COMMANDER F. A., U.S.N.R.,
c/o Inspector of Naval Materiel,
Atlanta 3, Ga.
WHITBECK, ROLAND A., Secy.-Treas.,
Gilron Products Co.,
Cleveland 3, Ohio
WHITNEY, LESLIE C., Ch. Met.,
Copperweld Steel Company,
Glassport, Pa.
WHITTEN, J. L., Sales Mgr.,
Lee Wilson Engineering Co.,
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WHYTE, R. B., Gen. Supt.,
Macwhyte Company,
Kenosha, Wisconsin
WICKWIRE, CHESTER F., Vice Pres.,
Wickwire Brothers, Inc.,
Cortland, New York
WILEY, WILLIAM G., Asst. to Gen. Sales Mgr.,
General Cable Corp.,
New York 17, N. Y.
WILKIN, ROBERT C., Pacific Coast Mgr.,
Phelps Dodge Copper Products Corp.,
Los Angeles 22, Calif.
WILLIAMS, ROBERT C., Ch. Chemist,
The Ironsides Company,
Columbus 16, Ohio
WILSON, FRANK B., Gen. Wks. Mgr.,
Guest, Keen & Nettlefolds, Ltd.,
Atlas Works,
Darlaston, So. Staffs., England
WILSON, JOHN L., Controller,
Plastoid Corp.,
New York 7, N. Y.
WILTRAKIS, JOS. E., Sub. Div. Chief, 9901-B,
Western Electric Company,
Kearny, New Jersey
WIND, WILLIAM J., Secy.,
Wilbur B. Driver Company,
Newark 4, New Jersey
WINKLER, L. H., Met. Engr.,
Bethlehem Steel Company,
Bethlehem, Pa.
WINSLOW, ALBERT E., Ch. Designer,
The Atwood Machine Company,
Stonington, Conn.
WINTERSOHL, A. H., Supt.,
Firthaloy Div.,
Firth-Sterling Steel Co.,
McKeesport, Pa.
WOOD, JAMES C., Supt. Wire Mill,
Columbia Steel Co.,
Pittsburg, Calif.
WOOD, MAURICE L.,
Chase Brass & Copper Co., Inc.,
Waterbury, Conn.
WOODHEAD, R. R.,
Stevens Nelson Paper Co.,
New York, N. Y.
WOOLDRIDGE, J.,
Johnson & Phillips, Ltd.,
Victoria Works,
Charlton, London S.E. 7, England
WRIGHT, ALBERT, Owner,
Albert Wright,
Oakland 8, California

YOUNG, LAFE, Gen. Supt.,
Laclede Steel Company,
Alton, Illinois
ZAPP, A. R., Mgr., Firthaloy Div.,
Firth-Sterling Steel Co.,
McKeesport, Penna.
ZARAFU, HERMAN, Plant Engr.,
Circle Wire & Cable Co.,
Maspeth, L. I., New York
ZUCKER, LEONARD A., Gen. Mgr.,
Union Wire Die Corp.,
Stamford, Conn.
ZUR, JOHN P., Met. Engr.,
Trauwood Engineering Co.,
Cleveland, Ohio

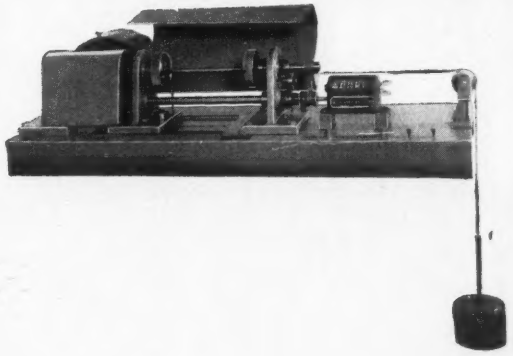
Addenda
Wire Association Membership List
1944

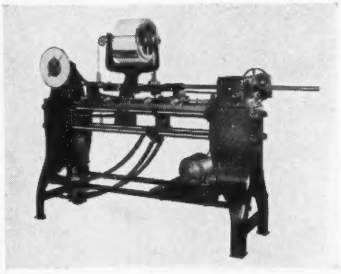
FEY, M. J., Wire Supt.,
Nichols Wire and Steel Co.,
1725 Rockingham Road,
Davenport, Iowa

McFARLANE, EUAN P., Mgr.,
Bethel Machine Co.,
313 Main Street, (Rear)
Danbury, Conn.
NICHOLS, FRANK P., Pres.,
Nichols Wire & Steel Co.,
1725 Rockingham Road,
Davenport, Iowa
O'ROURKE, C. F.,
Flexo Wire Co.,
638 W. Genesee St.,
Syracuse 1, N. Y.

The 1944 Convention
of the Wire Association
will be held at
PITTSBURGH, PA.
October 16-19 Inclusive

TWIST TESTER FOR WIRE





Model Q-7 Scott Tester. Heavy duty tensile tester for wire, with capacity of 2,000 lbs.

*Scott Tester Model T-3, illustrated above, is a new dual-rotation model which greatly accelerates the test. Specimens may be any length from 2" to 8". Various degrees of tension from ½ lb. to 17 lb. may be applied. The Scott line includes some 60 other models comprising machines for wires from finest filament to 1 ton, testing for tensile, hysteresis, flexing, compression-cutting of rubber covering, etc.

Request Bulletins

HENRY L. SCOTT CO.

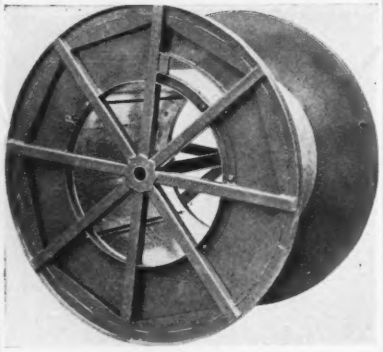
55 Blackstone St. **SCOTT TESTERS** Providence, R. I.

*Registered Trademark

Scott Testers — Standard of the World

ALL STEEL REELS

FOR SHIPPING
FOR STORING
CABLE AND WIRE



Last Longer

Constructed of corrosion resisting materials, three to four times the life of a wooden reel is a reasonable expectancy.

Give Greater Protection

Smooth inner surfaces, much greater strength with the absence of all cutting or abrading projections — these protect not only the cable but the men handling it.

Save On Freight

Appreciably lighter than wooden reels — cost less to ship — a cumulative saving that more than offsets increased first cost.

Reduce Investment

The longer life of R. B. Hayward Steel reels reduces the investment in reel equipment.

Write for description of construction and prices.

R. B. HAYWARD CO.

1714 Sheffield Ave.

Chicago, Illinois

What Is the Outside Area of That Wire?

IT is often important to know the outside area of wire, particularly when it is desired to treat the outside, or to cover it, or to find the heat radiating possibilities when the wire is used for heating, etc.

✦ ✦ ✦

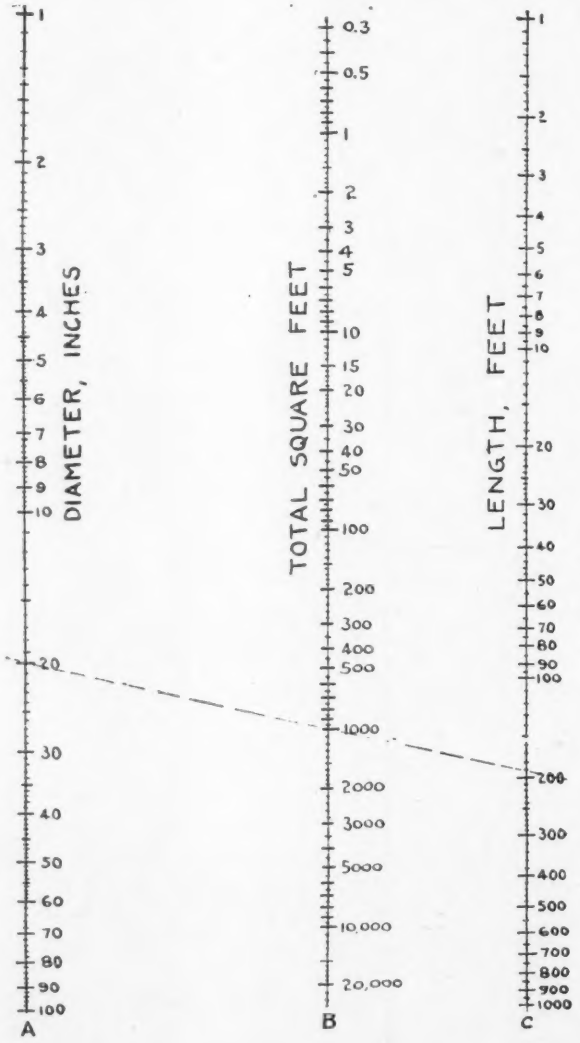
HERE is a chart that will be found handy by those who have occasion to make such calculations. Regardless of the diameter it can be found in column A. And regardless of the length, it can be found in column C.

✦ ✦ ✦

THUS for example let us say that we have a huge wire or "shaft," 20 inches in diameter, column A, and 190 ft. long, column B. The dotted line drawn across the chart and through those points shows that the outside area is 1000 sq. ft.

✦ ✦ ✦

MOST wires, of course, are considerably smaller than 20 inches. In fact they are smaller than one inch. But that makes no difference to this chart. Let us suppose, for example, that you have a wire 0.2″ in diameter and 19000 ft. long. The answer is still 1000 sq. ft. because, as you will note, we have moved the decimal point two places to the left in column A and two places to the right in column C.



✦ ✦ ✦

IN other words, if you move the decimal point one place to the left in column A you must also move the decimal point one place to the left in column B. Likewise if you move the decimal point one place to the left in column C you must also move the decimal point one place to the left in column B. And so on.

✦ ✦ ✦

TO make sure that everything will be understood, let us take a number of problems, using the same dotted line drawn across the chart for every problem so there will be no confusion, as follows:

Problem	Diameter of Wire	Length of Wire	Area of Wire
1	20″	190 ft.	1000 sq. ft.
2	2″	190 ft.	100 sq. ft.
3	0.2″	190 ft.	10 sq. ft.
4	0.02″	190 ft.	1 sq. ft.
5	0.002″	190 ft.	.01 sq. ft.
6	0.0002″	190 ft.	.001 sq. ft.
7	0.0002″	19 ft.	.0001 sq. ft.
8	0.0002″	1.9 ft.	.00001 sq. ft.

STUDY these problems a few moments, apply the chart to several problems of your own, and you will soon find that the operation is exceedingly easy and time-saving. Also, the chart will be found handy for estimating and for checking one's "hand figuring" should you decide to do your figuring longhand. The chart will figure the outside area of any wire of any diameter and any length.

Tension and Velocity Controls

(Continued from Page 691)

AN excellent example is shown in the photograph Figure 9 covering the application of a variable speed transmission to set the operating speed of a cable lacquering system. Also including a piston type hydraulic control transmission to maintain tension and velocity controlled from a compensator sheave and driving a large wind-up reel. Included is a small variable speed drive arranged for wide ratio to control the rate of traverse of the wire as wound on the reel.

✦ ✦ ✦

THIS is a complete compact self-contained mechanism built by a large industrial oven manufacturer and is useable for windup or unwind control.

✦ ✦ ✦

Proposed Commercial Standard For Grading Diamond Powder

IN connection with the establishment of standards for grading Diamond Powders the following suggestions from a well known authority on the subject will be of interest.

✦ ✦ ✦

The Editor.
Wire and Wire Products
300 Main Street
Stamford, Conn.
Dear Sir:

Many thanks for sending me the copy of the "Proposed Commercial Standard for Grading Diamond Powder (TS-3760 June 27, 44) as issued by the National Bureau of Standards and Weights; this affords me the first opportunity to read it,

Its first paragraph stating its purpose, fills a long felt need and was outlined in my booklet "Diamond Powders in Industry" which was widely publicized up to 1939.

The Standard proposed seems to cover the general subject adequately, although viewed from the standpoint of the Wire trade, there are some points which require being covered in greater details.

For instance under "Table 1. Grades "die makers and wire mills are offered 8 grades of powder from 0 to 85 microns. I believe that the range of sizes of most of these grades is too wide. The list also falls short of filling all requirements for the performance of the usual operations of drilling and polishing of diamond dies in sizes from .0008 to .080.—

Further, No. 15 "Guarantee." I suggest that diamond powder should be made out of virgin bort only and that this condition be embodied in the "Guarantee." (I gave the reason on p.482 of W. & W. P. Aug. issue).

Among other things, as impurities in diamonds are found in no greater amounts than minute traces, powders should be peremptorily rejected if a simple microscopic inspection shows the amount to be greater.

These are some of the points which I suggest should be examined.

Very truly yours,
P. L. H.

✦ ✦ ✦

Two New Bulletins On Heat Treating

SURFACE Combustion, Toledo, Ohio, offers two bulletins which are available on request. These are SC-119, entitled "Soft Metal Melting With SC Furnaces," and SC-121, called "Surface Combustion Furnaces in the Production Line." Both are fully illustrated and include valuable tables on the properties of metals to which these furnaces apply.

WANTED

.015 galvanized annealed low carbon basic steel wire in 8″ coils on an AA-1 rating, in any quantity up to 10 tons weekly.

FOR SALE

We manufacture the following:

Fine Steel Wire on Spools, made to your requirements. Flat wire on spools. Our standard sizes .0035″ to .004″ thick by .018″ to .022″ wide.

Let us know your requirements.

LINCOLN WIRE CO.

49 WALKER ST.

NEW YORK 13, N. Y.

NILSON

AUTOMATIC PRESS AND FOUR SLIDE MACHINE

FOR SWAGING, STAMPING, PIERCING, BLANKING, FORMING OF COILED METAL

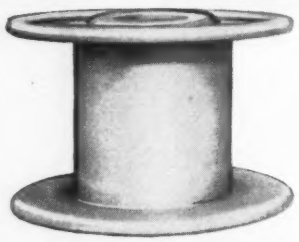
WE also build machines for forming Paper Clips, Buckles, Gate Hooks, Coat and Hat Hooks, Ceiling Hooks, Wire Ears, Cable Rings, Screw Eyes, Sash Chains, Automobile Side Chains, Flat Open Link Chains, Staples, Cotter Pins, Hose Clamps, Etc., and Wire Straighteners, Wire Reels, Frame Bending Machines and Special Presses.

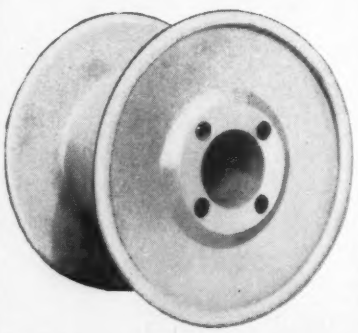
For Complete Details Address —

THE A. H. NILSON MACHINE CO.

BRIDGEPORT, CONN., U. S. A.

FOR HIGHEST SPEEDS





APCO MOSSBERG

PRECISION

STEEL REELS

The reels that are engineered to the job... designed and built by the company that originated the steel reel idea . . . are the reels you should be using in your plant. Every year, more and more Apco Mossberg Steel Reels are bought by quality-minded buyers throughout the wire industry.

FREE

ENGINEERING SERVICE

Without obligation to you. Apco Mossberg engineers will be glad to study your reel problem, and supply complete suggestions, drawings, blue prints. Write for information today.

REELS . . . SPOOLS . . . BOBBINS

APCO MOSSBERG COMPANY

(THE ORIGINAL FRANK MOSSBERG CO.)

21 LAMB ST., . . . ATTLEBORO, MASS.

Metropolitan Life Insurance Co. Issues New Safety Booklet

FEWER accidents mean less delay in getting essential materials finished and delivered where they are vitally needed. Many companies today are intensifying or supplementing their activities to reduce to a minimum accidents occuring on and off the job. A new report, **DEVELOPING SAFE EMPLOYEES**, based on accident-prevention activities of a number of industrial organizations, has been issued by the Safety Bureau of the Metropolitan Life Insurance Company as an aid in fostering such activities. Copies are now available for interested executives.

✦ ✦ ✦

AN excellent opportunity to acquaint the new employee with the safety policies of the company, the report observes, is presented through the initial interview and induction procedure. Proper placement or job assignment is another important step in developing the safe employee. Several of the tests and studies made to enable the placement department to give consideration to individual cases are described.

✦ ✦ ✦

THE experience of a number of companies indicates that the majority of accidents usually involve a comparatively small group of employees and that "accident-prone" tendencies are usually the result of fundamental characteristics of the employee, improper working conditions, and sometimes personal problems of the employee. A study of individual cases of accident-prone workers, the survey states, often enables the organization to determine the factors involved and to take corrective steps.

✦ ✦ ✦

MANY industrial executives, it was found, are giving practical recognition to the need of integrating safety training into job-training programs, whether this training is given in a class or individually, on the production line or in the assembling room.

CONTINUED interest and enthusiasm for safety programs may also be developed through the effective use of advertising within the plant. Among the types of publicity material used are displays of protective equipment, illustrated safety pamphlets, bulletin board material, house organ articles, contests and awards, local newspaper advertising, films and letters to employees. Many of these are illustrated in the report.

✦ ✦ ✦

New Company to Specialize in Carbide Finishing and Drilling

PRECISION Carbides Corporation, 1 Centre Market Place, New York 13, N. Y., has been organized by a group of men experienced in carbide dies, each an expert in this work, to serve the wire industry in precision die finishing and drilling on dies requiring finishing to tolerances of .0001 inches. This concern will specialize on extrusion, hammer, cold heading and drawing dies and tools, working on dies of any brand, and are prepared to finish to specification and deliver completed to the customer.

✦ ✦ ✦

New Catalog On Trucks and Trailers

A 56-PAGE catalog has just been issued by **The Howe Scale Company** of Rutland, Vermont, illustrating and describing its extensive line of warehouse trucks, trailers, dollies, platform skids, lift jacks, wheels, axles, and casters. Printed in two colors throughout, this catalog lists complete specifications for each product, illustrates many special as well as standard items, and is indexed alphabetically, by content and by code number for ready reference.

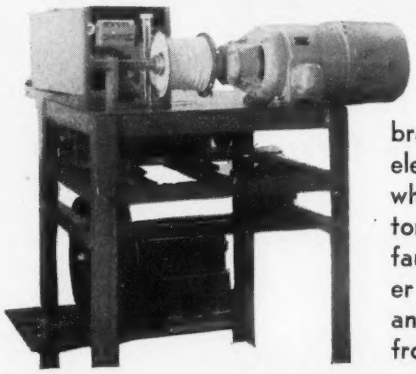
✦ ✦ ✦

A COPY of this helpful booklet may be obtained without obligation by writing to The Howe Scale Company, Rutland, Vermont, for Catalog P-15.

SPARKER for SPOOLING

SMALL WIRES

THIS APPARATUS WILL AUTOMATICALLY STOP WHEN DIELECTRIC FAULT OCCURS, or when the machine has wound a predetermined length of wire.



It is equipped with a gear head motor, electrical brakes on take-up and pay-off, electrode, control apparatus which automatically reduces the torque of the motor in starting, fault light indicator, transformer with tap switch, volt meter, and variac. Range of voltage from 1,000 to 16,000 volts.

Please Address Inquiries To:

R. L. DAVIS ELECTRIC CO., INC.

WALLINGFORD, CONN.

CARBIDE DIE COMPANY

1595 East Main Street

WATERBURY, CONN.

Manufacturers of carbide dies of all sizes and shapes for drawing, sizing, extrusion.

Specialists in the

RECUTTING and SERVICING

of new dies.

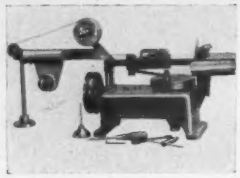
Authorized FIRTHALOY agent for The New England Territory.

PROMPT SERVICE ON ALL ORDERS

WIRE CUTTING & SHAPING MACHINES

For Wire From .0005" to 1/16" and Flat Stock up to 1/8"

No. 111

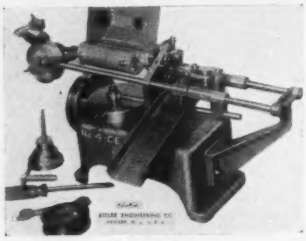


No. 4-E

Eisler fine wire cutting and forming machines have been in use over twenty-five years.

SEND US YOUR SAMPLES

No. 111-H



No. 4-CE

No. 111-AA

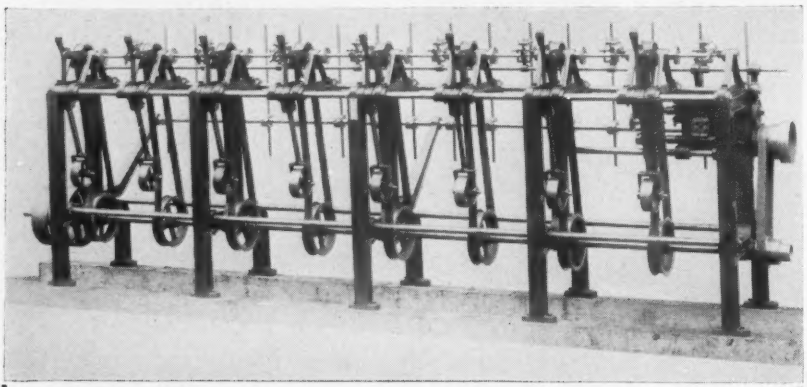
FOR INFORMATION WRITE

CHAS. EISLER

EISLER ENGINEERING CO.

747 South 13th St. (near Avon Ave.) Newark 3, N. J.

EISLER WIRE SHAPES



No. 1900E SPOOLER

WIRE SPOOLING MACHINES

Model illustrated takes spools up to 12" diameter. Floor space required: 19" x 10'; length can be varied to suit largest spool specified. Handles wire up to .050" diameter. Other models made to suit specific requirements.

EMORY SPOOLERS are built for years of continuous service. Precision made, durable, rugged, dependable.

BUILDERS OF WIRE SPOOLING MACHINERY FOR A HALF CENTURY

For details, write to

ROBERT J. EMORY COMPANY

31 East Runyon Street

NEWARK 5, N. J.

Telephone: Bigelow 3-4415

A Reappraisal of Electro-Galvanizing

(Continued from page 648)

down so close to it that the steel-to-zinc bond is atomic and is exactly similar to the forces which made the iron atoms cohere to each other. These forces of adhesion are, of course, operative on both electro and hot dip coatings. The difference is that in hot dip galvanizing such bonds link zinc-iron alloy to the steel and also the zinc to the zinc-iron alloy, while in electrogalvanizing the zinc is bonded directly to the steel. The bond in hot dip galvanizing does not appear to be inferior, but the intermediate zinc-iron alloy is of itself brittle. The hot dip coating breaks on bending, not because its bond is weak, but because a portion of the coating itself is weak and brittle and gives way. There is no brittle alloy in electrogalvanized coatings.

✦ ✦ ✦

PERHAPS the most important comparison between the two coatings is in their respective costs. Unfortunately it is impossible to give figures because these are not available for publication. The adherents of electrogalvanizing have been surprised and gratified at the unexpectedly low costs which have been recorded. Even at coatings of about 0.8 oz., which is its least favorable range, economies are realized by the electro process. Electrogalvanizing is not only superior in quality but less costly to apply.

✦ ✦ ✦

WHEN the first electrogalvanizing plants for wire were installed, the writer pointed out that hot galvanizing enjoyed the benefits of a century of practice, while electrogalvanizing still had to achieve its development. Although this statement was written very humbly, and seven years of mill practice have resulted in solid progress and greatly increased understanding of this process, the possibilities of electrogalvanizing are so vast that its potential development appears even greater today.

NEVERTHELESS, even now electrogalvanizing has thoroughly proved itself for wire. It gives a remarkably better coating at lower cost. It is certain that it will be used more and more with profit both to the manufacturer and user of this quality product.

✦ ✦ ✦

Salt Bath Annealing of Brass Cartridge Cases

A FULL anneal of brass cartridge cases on a continuous production heat treating basis is being accomplished with what are said to be the longest continuous conveyor-type salt bath furnaces in operation in America, and with an unequalled absence of oxidation.

✦ ✦ ✦

IN addition to the expected reduction in costs of operation plus the increase in speed, the feature of the operation which employs **Upton** Electric Salt Bath Furnaces is that the anneal on the brass is not only a full anneal but it is an absolutely bright anneal as well.

✦ ✦ ✦

WHILE this has been attempted on other occasions, it has never before been accomplished to the extent that the cases come out of the heat treatment clean and bright and without the slightest trace of oxidation, so that pickling or other cleaning is not required following the anneal.

✦ ✦ ✦

TWO furnaces are employed; each furnace capable of annealing 6,000 lbs. of brass every hour. One gives the cases a full anneal at 980° F. before the nosing operation. The second furnace full anneals the cases at the same temperature after the nosing operation.

✦ ✦ ✦

EACH of the two furnaces replaces ten individual non-continuous duty furnaces previously used with such savings that the management of the Detroit concern

(Please turn to Page 734)

TUNGSTEN CARBIDE DIES
for HEADING and
WIRE AND TUBE DRAWING (.030" to 2"), EXTRUSION (1/16" to 1"), RECUTTING AND WELDING ELECTRODE COATING.

RING GAUGES
DIAMOND DIES (.0015" up)
DIAMOND POWDER IN ALL GRADES

AIRCRAFT EXTRUSION DIES

As a special service to customers, we are prepared to give three day service on standard wire, tube and extrusion dies in cases of extreme urgency.

Address Inquiries to

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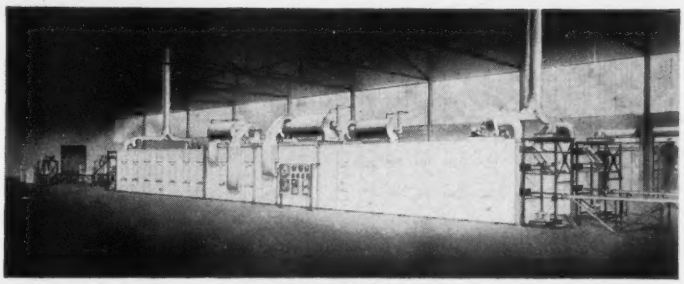
MORE PRODUCTION IN LESS TIME *with*
CARL-MAYER FURNACES, OVENS

CARL-MAYER HI-SPEED ROD BAKER

The fastest rod baker built! Saves up to 50% in time and fuel. Patented Blow-Off Feature removes moisture without bumping or agitating the coils. **Patented and patents pending.**



WELDING ROD OVEN
For drying coated welding rods. Uses the "Mayer" Recirculating Gas Fired Air Heater principle and Rod Transfer Systems (patents pending).

Growing interest in our type of equipment is evidenced by Carl-Mayer installations in such plants as:—

Atlantic Wire Co.
Atlas Tack Corp.
Atlas Steel Co.
Eaton Mfg. Co.
Hollup Corp.
Johnson & Nephew Ltd.
Page Steel & Wire Co.
Pittsburgh Tool Steel Wire Co.
Steel Co. of Canada
Wickwire Spencer Steel Co.

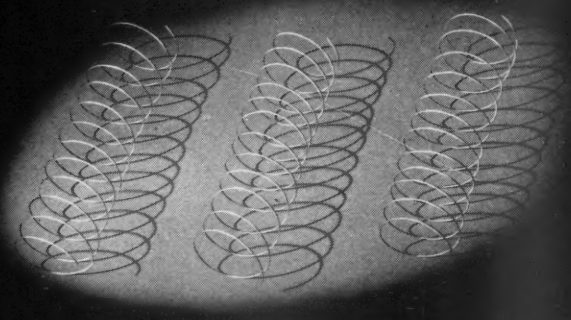
WRITE FOR BULLETIN #241

THE CARL-MAYER CORPORATION 3030 EUCLID AVENUE CLEVELAND, OHIO

JOHNSON *High Carbon Wire*

Shapes
Round — Half Round — Oval — Square — Flat
Triangular and Special Shapes

Finishes
Bright-Coppered — Liquor Finish — Bronze Plated
Tinned — Cadmium — Bright Galvanized
Oil Tempered Round — Flat and Shaped Wires



JOHNSON STEEL & WIRE CO., INC.
WORCESTER 1, MASSACHUSETTS
NEW YORK ATLANTA AKRON CHICAGO LOS ANGELES

OXYGEN FREE HIGH CONDUCTIVITY COPPER
OFHC
REG. U.S. PAT. OFF.

OFHC is a versatile copper.
It is an essential part of electronic devices.
In that capacity it is accompanying our armed forces everywhere.
Its unique qualities however do not restrict its use to special applications.
OFHC is a universal copper.

THE AMERICAN METAL COMPANY, LTD.
61 Broadway, New York, N. Y.

Salt Bath Annealing of Brass Cartridge Cases

(Continued from Page 733)

in whose plant the furnaces are installed is reported to have stated that "the furnaces paid for themselves in the first three weeks of operation."

✦ ✦ ✦

CASES from the previous operation are lowered into the molten salt at one end of the furnace pot and moved along through the molten salt at a rate of 60 feet per minute. After traversing the entire length of the pot, a "turnaround" area at the end permits the conveyor to bring the cases back through the pot for the additional time required for the full anneal. The conveyor is arranged so that the cases remain in the bath the required time, yet in such a way that drag-out of salt is kept to a minimum.

✦ ✦ ✦

THE annealing operation is not only continuous, but it is entirely automatic, with the exception of the occasional shovel full of salt required to replenish the salt lost through normal operation and from the nominal drag-out. The temperature of the bath is held within ± 50 F. by automatic electric temperature control. Moreover, should the temperature vary more than that pre-determined amount, a horn, installed on the temperature control panel and audible throughout most of the entire plant, will serve sufficient notice that a variation beyond the prescribed has been reached. (According to plant executives, the horn has not yet been heard from.)

✦ ✦ ✦

THE first furnace to be installed was equipped with removable covers with the idea that sufficient heat would be radiated from the salt to make them advisable. Salt is added through a small door in the covers at the turnaround end of the furnace. This furnace has been in continuous operation for 18 months and has been shut down only twice during that time for cleaning. This is an

exceptional record and constitutes a tremendous saving in time and money for both manpower and electrical power when it is known that prior to the installation of these salt bath furnaces, the previous equipment required shutdown for complete cleaning every week without exception.

✦ ✦ ✦

THE second furnace to be installed is not equipped with covers since, through experience with both the first furnace and this second installation, it has been found that the amount of heat lost is so small as to be not even worth the small additional expense. This furnace is placed on the floor, in contrast to the first, enclosed, furnace which was installed with its base approximately 3 feet above the floor. Thus, the furnaces can be installed to suit the existing production conditions to a large extent.

✦ ✦ ✦

UNIFORM temperature throughout the entire bath is made possible largely through the placement of electrodes which enter the sides of the furnace instead of being thrust in from above surface of the salt. These electrodes, which conduct the current into the bath from the transformers located outside the furnace, are so positioned that the transfer of current through the salt generates the heat at the bottom of the pot rather than anywhere above that point. The result is that a normal flow of heated salt circulates upwards as is natural under the basic laws of physics, thereby heating the entire contents of the bath evenly and uniformly. Electrodes of this type, which are not exposed to the combined action of salt and oxygen, appear to be capable of lasting almost indefinitely, since in the 18 months of continuous operation, no replacements have been required.

✦ ✦ ✦

AN additional advantage of this electrode design in conjunction with the full ceramic pot permits the use of ordinary commer-

(Please turn to Page 736)

DIAMOND WIRE DRAWING DIES

Fort Wayne Wire Die Co., is housed in a new and up-to-date plant with every modern facility for producing dies under working conditions that make for quality. Although larger quarters were built last year, we have had to expand further to keep pace with the demands for more of these excellent dies.

The name "Fort Wayne" stands for the finest in quality and craftsmanship. Our customers can expect courteous and co-operative service on every order, and we strive to make each die so well that it will merit your good-will.

Range of Sizes: .0006" to .102"

You are invited to consult us on your diamond die problems. Please address inquiries to:

FORT WAYNE WIRE DIE COMPANY

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Telephone: Harrison 4319

SUPER-HARD
TALIDE
DRAWING DIES
WITH TUNGSTEN CARBIDE NIBS OF EXCEPTIONAL DENSITY, STRENGTH AND HARDNESS . . . INSURE
● BETTER FINISH ● GREATER ACCURACY
● LONGER LIFE ● FEWER REJECTS
on Drawing and Extruding WIRE, RODS, BOLTS, RIVETS and TUBING
TALIDE DIES are manufactured in all standard round hole sizes from R-1 to R-18
SPECIAL SHAPE DIES
Oval, Square, Triangle, Hex etc., made to order
SHEET METAL DIES
extra large for deep drawing, cartridge cases, liners, and cans, are also made with TALIDE NIBS
FULL PARTICULARS ON REQUEST
WRITE OR WIRE TODAY!

METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

Model 4-SD-3 on New England Butt Braiders

Model SD Counters installed on Braiding Machines record production and establish a fixed cost of braiding per foot. Furnished with outside gearing as illustrated, or with internal gearing and flexible coupling for direct connection to capstan, and recording directly in feet.

Controlled Production

an essential in the Wire Industry

PRODUCTIMETERS installed on your production machines give accurate measurement throughout various wire processing . . . provide records for efficient scheduling and control. They are ruggedly built, precision designed to meet all-out production demands.

The line is complete . . . with models for different types of materials; capacities from 0" to 3½" diameter; speeds from 600 to 5000 feet per minute. Write our Engineering Department about your measuring problems.

Send for Catalog 3 for complete details!

DURANT MANUFACTURING COMPANY

1918 N. Buffum St., Milwaukee 1, WIS. **PRODUCTIMETERS** 176 Eddy St., Providence 3, R. I.

THE SPEEDOMETERS OF INDUSTRY

PARALAN OIL and other LANOLIN PROTECTIVE COATINGS

PROTECTIVE COATINGS for STEEL & WIRE

Manufactured By

AMERICAN LANOLIN CORP.

LAWRENCE, MASS.

Cleveland Office: 15900 Lake Ave., Lakewood 7, Ohio

Waterproof and Crepe Paper

In rolls of any size for wrapping coils and reels.

Crepe-Kraft Barrel Liners

The Crepe-Kraft Company

112 Adams St., Newark, N. J. Tel.: Market 2-0375

Salt Annealing of Brass Cartridge Cases

(Continued from Page 735)

cial nitrate salts, further reducing heat treating costs. Moreover, in addition to the reduced cost of the salts, only 20% of the volume of salt used previously by the individual furnaces is now required for the new, continuous bright anneal furnaces.

✦ ✦ ✦

The Western Electric Oscillator

ON September 1st a Western Electric publication well-known to the radio industry before the war as **pick-ups** once again makes its bow under the new title, **The Western Electric Oscillator.** Including a bright cover done in the war theme by artist Paul Rabut, the publication presents 36 pages of technical and allied information of interest to broadcasting and electronic people. The editor is Will Whitmore with Vance Hilliard, assistant.

✦ ✦ ✦

IN its initial issue the publication carries a number of articles of significance to the radio industry. The lead story, "Radio Fights Its First War" by George de Mare, tells definitively how the men and women of the profession are standing up to their wartime responsibilities. The article is based on a comprehensive survey of individual broadcasting stations throughout the nation. Other titles include "FM Goes to War," "You Can't Win a War Without Radio," "A. T. & T. Plans for Television" and "Seventy-Five Years of Pioneering by Western Electric," a two- page spread of historic pictures starting with the founding of the Company and extending to its 75th Anniversary this year.

✦ ✦ ✦

IN addition to a profusion of interesting photographs done in the modern vein, the publication contains a dramatic spread of four full-page pictures in color.

How Many Lineal Feet in That Coil of Rope, Hose, Cable, Etc.?

MANY materials come in coils these days—wire, cable, rope, hose, lead pipe, tubing, etc.—coiled as pictured in the sketch on the accompanying chart. The chart will be found useful for finding the length in feet of anything of the sort, coiled as shown. All that is necessary is to count the number of turns and measure the "average" diameter as shown in the sketch, and then lay a straightedge across the chart as indicated by the dotted line. The answer is immediately found in column B.

✦ ✦ ✦

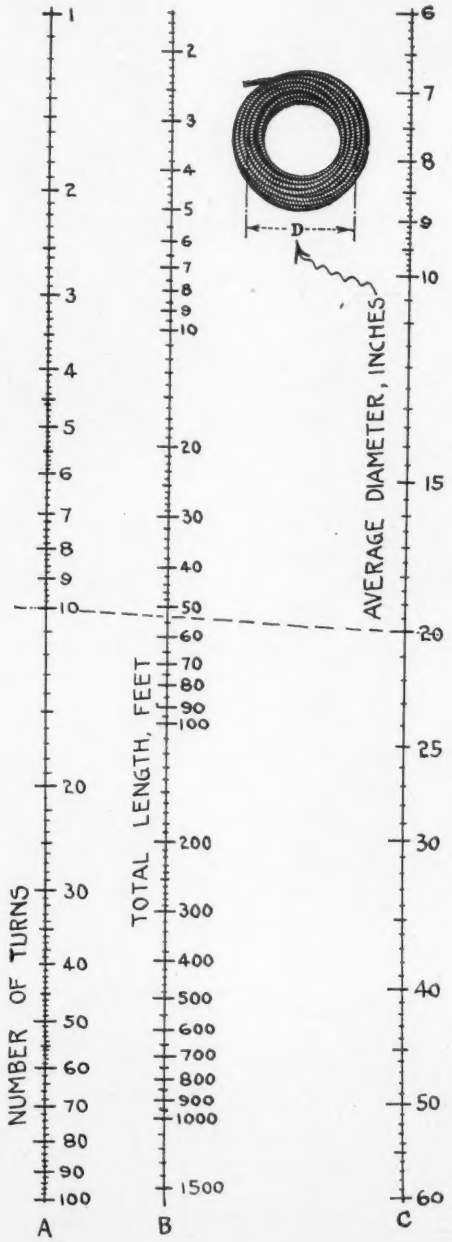
FOR example: To find the number of feet in a coiled cable having an average diameter of 20 in. and in which there are 10 turns connect the 10 in column A with the 20 in column C as the dotted line shows, and the intersection with the middle column gives the answer, namely, 53 feet.

✦ ✦ ✦

AS will be noted, the range of the chart is great enough to take care of most of the conditions that are found in regular everyday practice.

✦ ✦ ✦

IN addition, the chart may be used "backwards" as well. For instance, if it is desired to take along on a job about 300 ft. of a coiled-up article, and you want to know how many turns to take, or want to be sure that you have enough, a straightedge laid across the 300 on the middle scale will tell you how large the coil should be made and the number of turns required in order to contain the desired length. Paste this scale on a card and hang it in a convenient place. You will find it to be useful every once in a while.



Advertising is a definite service to a concern's customers. It helps the buyer to locate and keeps him reminded of the most reliable sources of supply. Read the advertising, answer it if it concerns you, and say you saw it in WIRE & WIRE PRODUCTS.

Manufacturers of

STAINLESS STEEL

and

MUSIC WIRE

ALL SIZES — ALL TYPES

ROUND SPECIALTY WIRE

Wire Straightened and Cut to Length.

All types of wire redrawn to specifications.

Address inquiries to

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WIRE CUTTING MADE EASY

Hard wire*, spring wire, as well as soft wire, wire fabric, tie wire, fencing, etc. — easily and quickly cut with a porter tool. A standard model for average needs. Special models for special work.

Send for catalog showing all Porter models of wire cutters, bolt clippers, etc.

(with center cut round edge jaws)

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EVERETT 49, MASS., U.S.A.

PORTER HKP CUTTERS

ACID AND ALKALI PROOF
LININGS AND MORTARS

●

ACID PROOF
CONSTRUCTION

●

THE CEILCOTE CO.

Consulting and Research Engineers

750 ROCKEFELLER BLDG.
CLEVELAND, OHIO

Norton Acquires Rights to Bura-way Precision Form Grinder

NORTON COMPANY, of Worcester, Massachusetts, builders of a comprehensive line of cylindrical and surface grinders, tool room grinders, and lapping machines, has acquired all design and mechanism patents, copyrights, drawings, and all manufacturing and sales rights pertaining to the Bura-way Grinder. This unique tool and form grinding machine will henceforth be built and sold under the name "NORTON Buraway".

✦ ✦ ✦

THIS grinder will allow the tool room to establish new standards of accuracy, achieving important economies in tool maintenance. It will assist in centralizing tool crib control and will place once again in the hands of expert tool supervisors and production engineers the determination of critical tool relief angles, frequently left just to the judgment of the individual shop hand.

✦ ✦ ✦

Carboloy Company to Feature Agents' Products At Metal Show

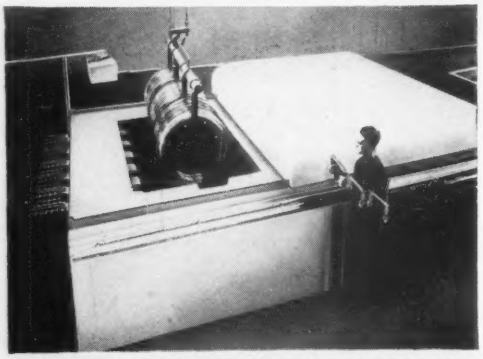
PRODUCTS made by independent tool manufacturers using cemented carbides supplied by **Carboloy Company** will be the feature attraction of the exhibit of the Carboloy Company, Inc., Detroit 32, at the 1944 National Metal Exposition in Cleveland, Ohio. The projected exhibit will include a wide variety of the special tools and cutters which are produced by such independent companies.

✦ ✦ ✦

IN addition, there will be a display of their complete line of standard tools, standard blanks, etc., and also the company's series of training slide films on the design, care, and use of carbides.

✦ ✦ ✦

IN addition to its Cleveland staff the company will be represented by **K. R. Beardslee,** Vice President in Charge of Sales: **J. R. Longwell,** Director of Research and Engineering and others.



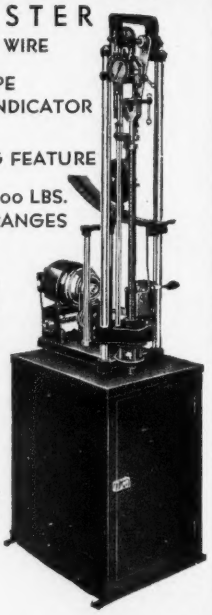
300 K.V.A. Edicurrent Furnace annealing wire at the rate of 1000 pounds each 15 minutes. Larger units than this are in operation as there is practically no limit to the size of pot or number of electrodes which can be employed.

THE BELLIS HEAT TREATING COMPANY Branford, Connecticut

AMTHOR
STANDARD TENSILE STRENGTH
TESTER
FOR LIGHT WIRE

DIAL TYPE
ELONGATION INDICATOR
WITH FIXED
READING FEATURE

MAX. CAPACITY 300 LBS.
IN THREE SUB-RANGES



Write For Literature On Higher Capacity Tester to 1500 lbs.

"NEW Low Capacity Tester for Very Fine Wires"

All Testers Can Be Graduated In Either Metric or English System

AMTHOR
TESTING INSTRUMENT CO., INC.
55 VAN SINDEREN AVE., BROOKLYN, N.Y

Oakite Pre-Coating Provides 3 Advantages!

More wire mill superintendents are discovering that by using Oakite Composition No. 24 for smut removal and pre-coating prior to liming in the cleaning house, they obtain these three outstanding advantages:

1. It neutralizes all acid remaining on rod and also removes traces of iron sulphate.
2. Oakite Composition No. 24 adheres firmly to the rod or wire so that no rusting or pitting occurs on the surface.
3. As an undercoating, it serves as a carrier for an even lime coating which in turn assures better adherence of the die box lubricant.

Because it so satisfactorily meets these requirements, Oakite Composition No. 24 makes possible better wire, more tonnage from the same equipment, less rejected wire. Details FREE!

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Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE Buy Bonds for Victory
MATERIALS...METHODS...SERVICE

Developing A Safety Program in Wire Mills

(Continued from Page 663)

in any plant is one of the finest morale builders. It takes the hazard out of the job by creating safe conditions. Such conditions lead to happier personnel, lower turnover, better work and resulting better product with more satisfied customers. A systematic safety program—followed up day by day and week by week—cannot fail in its results. When we realize that we kill and maim more people in this country every year than we have in the battles now being fought all over the world, the significance of conserving manpower is self-evident.

✦ ✦ ✦

Some Problems Influencing the Drawing of Fine Wire

(Continued from Page 653)

size. However, after a while it will wear out and run in the limits of size .0013" where it can be used without being repolished. We must repeat again that this depends on the shape being satisfactory.

✦ ✦ ✦

PARTLY the required limits in ohms conform to this suggestion but there is no complete unity, between the standards of different companies using this resistance wire nor is the continuation as outlined above followed through the whole line of sizes.

✦ ✦ ✦

REPOLISHING is a loss. Moreover, as it is often, wire falling out of limits cannot be used at all and is only increasing the waste percentage. Die life for other materials can be determined in the same or similar way although it should be mentioned that die cost, because of the low wear, as for instance in the case of copper, is not as influential a factor on final cost price as in the case of the heavy wearing materials.

✦ ✦ ✦

THE manufacturing difficulties of fine wire are many but the job is worth the efforts considering the many applications and their importance to the armed forces as well as to civilian life.

WIRE MEASURING MACHINE

FOR LINEAR MEASURE

PROVIDES NEW STANDARD OF ACCURACY

Illustration Shows Exclusive Patented "3V" Principle

Measuring twisted, armored, bare or insulated wire without vibration or inaccuracies at any speed or varying speeds!

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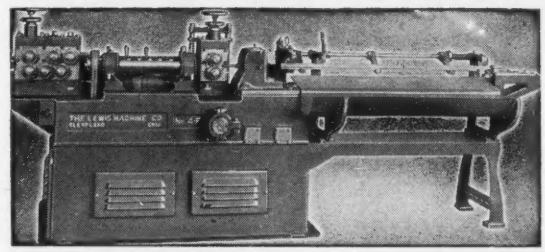
LYON-VAIL MACHINE CO., INC.

97 Belmont Street, BROCKTON, Massachusetts

LEWIS TRAVELCUT WIRE STRAIGHTENING and CUTTING Machines



Machines for 1/16" to ¾" rod

Round
Square
Flat
Hexagon
Ferrous and Non-Ferrous

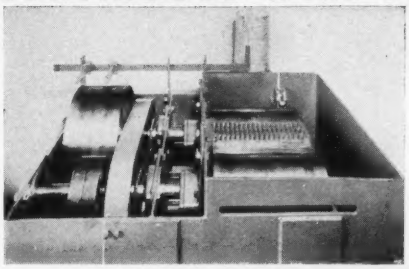
Automatic
High Speed
Heavy Duty

The Sign of Dependable Service:

WE CAN SUPPLY AND ENGINEER OUR TOOLS EQUIPPED WITH CARBOLOY CEMENTED CARBIDE

THE LEWIS MACHINE CO., 3445 E. 76 St., Cleveland, Ohio

CONTINUOUS WIRE DRAWING MACHINE



for low carbon, high carbon and alloy wires, with provision for twenty drafts. Spooling attachment furnished if desired.

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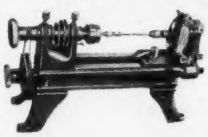

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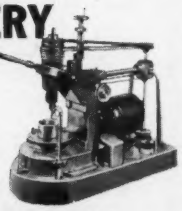

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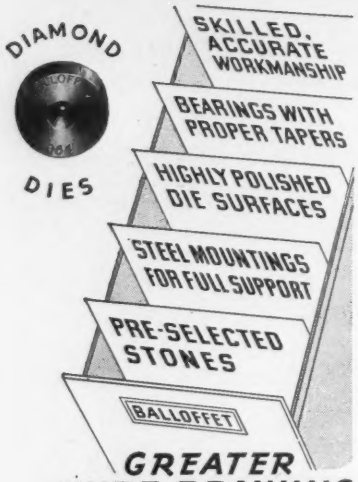

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New Tool Company Organized in Glendale, Calif.

ANNOUNCEMENT of the organization of **Demco Tool Service Inc.**, with headquarters at 5236 San Fernando Road, Glendale, Calif., has been made.

✦ ✦ ✦

THE new organization is headed by **Russell W. Luzius**, for the past two years on the West Coast, handling lines of cutting tools, and formerly Tool Engineer with General Motors Corporation. It will provide complete field engineering service on gear production, broaching, tapping, thread milling, and all forms of general machining including the use of both HSS and carbide cutting tools.

✦ ✦ ✦

IN addition, Demco is providing complete tool reconditioning services and is also being equipped to handle job-broaching for West Coast manufacturers.

✦ ✦ ✦

THE companies represented by Demco include Michigan Tool Company, Colonial Broach Company, Detroit Tap & Tool Company, Tungsten Carbide Tool Company, Colonial Bushings, Inc., and New Method Steel Stamps, Inc., all of Detroit and Genesee Tool Company of Fenton, Michigan.

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American Iron and Steel Institute Issues Statistical Report For 1943

THE Thirty-Second Annual Statistical Report, by American Iron and Steel Institute has just been published. It presents statistics covering the iron and steel industry of the United States for the year 1943, and of Canada and some other foreign countries for the year 1940 and preceding years. Most of the tables in this report include comparable data for at least four or five preceding years.

✦ ✦ ✦

EIGHT important new sets of figures are included in this report. One new table shows production of coke by pig iron and steel producers and a second shows production of alloy steel ingots by compositions. The six other new tables show, respectively, consumption of: coal, fluxes, fuel oil, natural gas, tar and pitch, and electric power by the iron and steel industry.

✦ ✦ ✦

DETAILS of statistics of United States imports and exports for the years 1941, 1942 and 1943 are not available. However, this report includes such data which are available for 1940 and previous years.

✦ ✦ ✦

Treating Cable Rash

ACCORDING to **T. P. Connelly** and **W. C. March** (U. S. Naval Med. Bull. 42:403, 1944) cable rash, now becoming more common in shipyards, arises from contact with waterproofed and fireproof cable impregnated with chlorinated naphthalene, chlorinated diphenyl or chlorinated diphenyl oxide. In treating this condition, these physicians recommend nightly application of the following preparation after thorough cleansing of the skin. (It is to be washed off in the morning.)

Potassium sulfide (50% solution, filtered)	**60.0**	**cc.**
Zinc oxide	**30.0**	**Gm.**
Precipitated sulfur	**30.0**	**Gm.**
Glycerine, C. P.	**5.0**	**cc.**
Soluble fluid rose	**1.0**	**cc.**

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Rolling Mill and Wire Mill
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1—Two Spindle Bull Block Motor Driven
6—Lewis Welding Wire S. & C. Machines M. D.
2—Shuster Shaped Wire S. & C. Machines ½" & ⅞" Square, Hexagon & Round Stock Capacities
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Wanted: Tack Making Machinery. All Sizes.
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Garrett Supply Company Appointed Carboloy Distributor For Southern California-Arizona

GARRETT Supply Company, 3844 South Santa Fe, Los Angeles 11, has been appointed **Carboloy** distributor for the Southern California-Arizona area, according to an announcement made recently by **K. R. Beardslee,** Vice-President in Charge of Sales for Carboloy Company of Detroit, Michigan. This move supplements direct service operations of Carboloy Company's branch at 5905 South Pacific Blvd., Los Angeles, which pioneered the use of carbide on the West Coast as far back as 1929.

✦ ✦ ✦

APPOINTMENT of the **Garrett Supply Company** will insure that carbide users in Southern California and Arizona will obtain immediate delivery from larger West Coast stocks on such vital items as standard carbide tools; standard blanks for all types of cutting tools; diamond-impregnated wheel dressers; carbide tipped masonry drills; etc.

✦ ✦ ✦

A CARBIDE Training Course covering the fundamentals of modern carbide practice is to be conducted at Garrett's headquarters in Los Angeles by Garrett representatives who have completed a training course in all technical aspects of carbide tools—design, brazing, grinding, trouble shooting, etc.—at the Carboloy plant in Detroit. This course will be available to key men responsible for carbide use in Southern California and Arizona plants. This Company is the first distributorship in the country to set up such a Carbide Training Course.

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For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

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Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

ACID-PROOF CONSTRUCTION—
Ceilcote Co., The, Cleveland, Ohio
Heil Engineering Co., Cleveland, Ohio

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ALKALINE CLEANERS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

ANNEALING MACHINES—
Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

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American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—Flash
Morrison Engr. Corp., Cleveland, Ohio

BAKERS—Hi-Speed
Carl-Mayer Corp., The, Cleveland, Ohio.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Morrison Engr. Corp., Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

BELTS—Wire
Wickwire Spencer Steel Co., New York, N. Y.

BENDERS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BILLETS—Electrolytic Copper
American Metals Co., Ltd., New York, N. Y.

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Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

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Keagler Brick Co., Steubenville, Ohio.

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CABLE REEL BORERS—
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CABLE—Steel and Copper
Brewer Mfg. Co., Muncy, Pa.

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Apco Mossberg Co., Attleboro, Mass.
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Sauereisen Cement Co., Pittsburgh, Pa.

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Norton Co., Worcester, Mass.

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Standard Industrial Compounds Co., Chicago, Ill.

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Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

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Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., New York, N. Y.

COATING COMPOUNDS—
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Gilron Products Co., Cleveland, Ohio
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

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Torrington Mfg. Co., Torrington, Conn.

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Heil Engineering Co., Cleveland, Ohio

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Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn

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COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
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COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Wire Drawing
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Gilron Products Co., Cleveland, Ohio.
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Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
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Standard Industrial Compounds Co., Chicago, Ill.

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Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

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Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

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Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Wks., New York, N. Y.

DIAMOND POWDERS—
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Rusch Wire Die Corp., New York, N. Y.
United Die Co., Newark, N. J.

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Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Master Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
United Die Co., Newark, N. J.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.
United Die Co., Newark, N. J.

DIES—Repairs & Re-Cutting
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Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Co., Waterbury, Conn.
Carboloy Co., Inc., Detroit, Mich.
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Kelly Wire Die Corp., New York, N. Y.
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Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.
United Die Co., Newark, N. J.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Co., Waterbury, Conn.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Co., Waterbury, Conn.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Co., Waterbury, Conn.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
Precision Carbides Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIRECT ELECTRIC RESISTANCE HEATING—
Trauwood Engr. Company, Cleveland, Ohio

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING AND PRE-HEATING ROOMS—
Industrial Oven Engr. Co., Cleveland, O.

DRYING EQUIPMENT—
Rockwell, W. S., Co., New York, N. Y.
Ross, J. O., Engr. Corp., New York, N. Y.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WHERE TO BUY, Continued

FENCES AND FENCING—Wire
Wickwire Spencer Steel Co., New York, N. Y.

FLASH BAKER—
Morrison Engr. Corp., Cleveland, Ohio

FLUX—Galvanizing
Dewey & Almy Chemical Co., Cambridge, Mass.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Oven Engr. Co., Cleveland, O.

FURNACES—Annealing
Ajax Manufacturing Co., Cleveland, Ohio
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Morrison Engr. Corp., Cleveland, Ohio
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Electric
Ajax Manufacturing Co., Cleveland, Ohio
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio

FURNACES—Hardening & Tempering
Ajax Manufacturing Co., Cleveland, Ohio
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Rockwell, W. S., Co., New York, N. Y.
Schloemann Engr. Corp., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Non-Oxidizing
Ajax Manufacturing Co., Cleveland, Ohio
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Normalizing
Ajax Manufacturing Co., Cleveland, Ohio
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Pot (Oil, Gas and Electric)
Ajax Manufacturing Co., Cleveland, Ohio
Bellis Heat Treating Corp., Branford, Conn.
Holden, A. F., Co., New Haven, Conn.

FURNACES—Salt Bath
Ajax Manufacturing Co., Cleveland, Ohio
Bellis Heat Treating Corp., Branford, Conn.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

GALVANIZING EQUIPMENT—
Meaker Co., The, Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

GALVANIZING FLUX—
Dewey & Almy Chemical Co., Cambridge, Mass.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

INSULATING MATERIALS — Electric Wire & Cable
Carbide & Carbon Chemical Corp., Plastics Div., New York, N. Y.
Owen-Corning Fiberglas Corp., Toledo, Ohio
Sprague Electric, North Adams, Mass.

JETS—Steam
Heil Engineering Co., Cleveland, Ohio

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LIQUID FOAM BLANKET—
Dewey & Almy Chemical Co., Cambridge, Mass.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
American Lanolin Corp., Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Ironsides Co., The, Columbus, Ohio
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Schloemann Engineering Corp., Pittsburgh, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable Reel Boring
Root, B. M., Co., York, Pa.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cold Heading with Wire Drawing Attachment
Ajax Manufacturing Co., Cleveland, Ohio

MACHINERY—Copper Wire Drawing and Rolling
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Cutting
Ajax Manufacturing Co., Cleveland, Ohio
Broden Construction Co., Cleveland, Ohio
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Inc., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.

MACHINERY — Die Making for Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Draw Benches
Ajax Manufacturing Co., Cleveland, Ohio
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.

WHERE TO BUY, Continued

MACHINERY—Extruding
Bonwitt, Eric, Akron, Ohio
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Schloemann Engineering Corp., Pittsburgh, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark 3, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
Eisler Engineering Co., Newark 3, N. J.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Meaker Co., The, Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Hydraulic Testing
Riehle Testing Machine Div. of American Machine & Metals, Inc., East Moline, Ill.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.
Schloemann Engineering Corp., Pittsburgh, Pa.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Schloemann Engineering Corp., Pittsburgh, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Broden Construction Co., Cleveland, Ohio.
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Mixing Mills
Bonwitt, Eric, Akron, Ohio

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Ajax Manufacturing Co., Cleveland, Ohio
Broden Construction Co., Cleveland, Ohio
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Amthor Testing Instrument Co., Brooklyn, N. Y.
Riehle Testing Machine Div. of American Machine & Metals, Inc., East Moline, Ill.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Equipment Sparkers
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
Shuster, F. B., Mfg. Co., New Haven, Conn.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark 3, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Industrial Oven Engr. Co., Cleveland, O.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark 3, N. J.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Cleveland, Ohio
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

WHERE TO BUY, Continued

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
Industrial Oven Engr. Co., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.

OVENS—Dehydrogenizing
Industrial Oven Engr. Co., Cleveland, O.
Rockwell, W. S., Co., New York, N. Y.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Oven Engr. Co., Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Ross, J. O., Engineering Corp., New York, N. Y.

OVENS—Welding Rod Coating
Industrial Oven Engr. Co., Cleveland, O.
Rockwell, W. S., Co., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COILS AND JETS—Steam
Heil Engineering Co., Cleveland, Ohio

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, O.
Heil Engineering Co., Cleveland, Ohio
Keagler Brick Co., Steubenville, Ohio.
Sauereisen Cement Co., Pittsburgh, Pa.

PIPES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lacquer
Industrial Oven Engr. Co., Cleveland, O.

POTS—Lead Melting
Industrial Oven Engineering Co., Cleveland, Ohio
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.

PRESSES—Hydraulic and Mechanical
Bonwitt, Eric, Akron, Ohio
Robertson, John, Co., Brooklyn, N. Y.
Schloemann Engineering Corp., Pittsburgh, Pa.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.
Schloemann Engineering Corp., Pittsburgh, Pa.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.
Schloemann Engineering Corp., Pittsburgh, Pa.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Brewer Mfg. Co., Muncy, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Lanolin Corp., Lawrence, Mass.
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Heil Engineering Co., Cleveland, Ohio

SATURATION SYSTEMS—
Industrial Oven Engr. Co., Cleveland, O.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Oven Engr. Co., Cleveland, O.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPRINGS—Steel
Wickwire Spencer Steel Co., New York, N. Y.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.

STEAM COILS AND JETS—For Acid Tanks
Heil Engineering Co., Cleveland, Ohio

STRAND—Steel and Copper
Brewer Mfg. Co., Muncy, Pa.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANK LININGS—Brick
Keagler Brick Co., Steubenville, Ohio.
Nukem Products Corp., Buffalo, N. Y.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TENSILE TESTERS—
Riehle Testing Machine Div. of American Machine & Metals, Inc., East Moline, Ill.
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Amthor Testing Instrument Co., Brooklyn, N. Y.
Riehle Testing Machine Div. of American Machine & Metals, Inc., East Moline, Ill.
Scott, Henry L., Co., Providence, R. I.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

WHERE TO BUY, Continued

TREADS—Safety
Norton Co., Worcester, Mass.
TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.
TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.
VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.
VULCANIZERS—
Bonwitt, Eric, Akron, Ohio
Watson Machine Co., Paterson, N. J.
VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
WELDERS—Spot and Butt
Eisler Engineering Co., Newark 3, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
WIND-UP AND UNWIND SYSTEMS—Continuous
Industrial Oven Engr. Co., Cleveland, O.
WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, Ohio.
WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio
WIRE—Enameled for Coils
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.
WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio
Spencer Wire Co., Spencer, Mass.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Bros., Inc., Cortland, N. Y.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.
WIRE—Music
American Brass Co., The, Waterbury, Conn.
Jersey Steel & Wire Corp., Irvington, N. J.
Johnson Steel & Wire Co., Worcester, Mass.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio
Spencer Wire Co., West Brookfield, Mass.
WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.
WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio
Wickwire Spencer Steel Co., New York, N. Y.
WIRE—Stainless Steel
Firth-Sterling Steel Co., McKeesport, Pa.
WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio
Spencer Wire Co., West Brookfield, Mass.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Bros., Inc., Cortland, N. Y.
Wickwire Spencer Steel Co., New York, N. Y.
WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
WIRE TESTERS—
Riehle Testing Machine Div. American Machine & Metals, Inc., East Moline, Ill.
Scott, Henry L., Co., Providence, R. I.
WIRE, WEAVING—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
WIRE WINDER—
Standard Mill Supply Co., Providence, R. I.
WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.
YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.
YARNS—
Cheney Bros., New York, N. Y.

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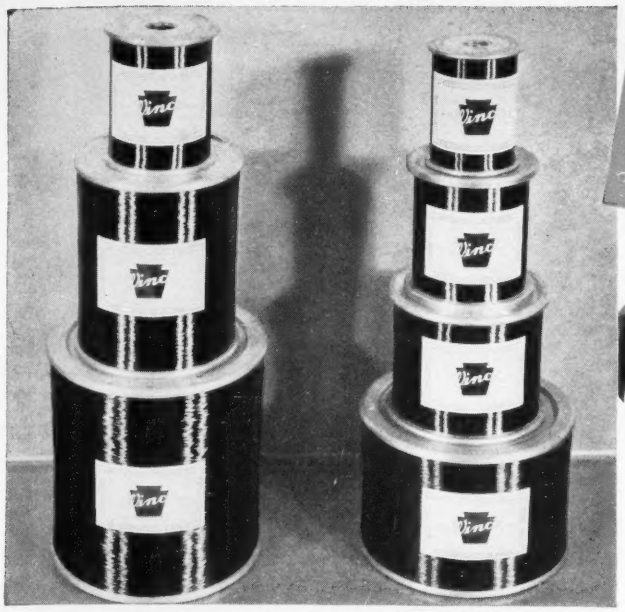

Custom built spools for high speed winding

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Checking raw materials

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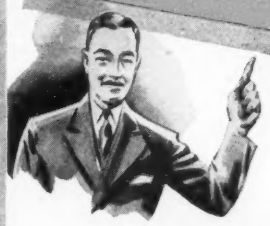

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QUALITY— All phases of manufacture, from ingot to final processing, are carefully supervised and fulfilled in the same manner you would carry out in your own plant. There are no unimportant phases in the work.

UNIFORMITY — By mercury process tests, our engineers can guarantee perfect uniformity in wire; from the smallest to the largest order. No more variations in consistency, structure or electrical properties . . . every inch of wire exactly as specified, more than meeting your requirements.

SERVICE—If you have a wire problem, our complete design and engineering facilities are at your disposal without obligation. Send your specifications and blueprints for our recommendations; or if you are not quite ready, write for samples of these quality products.

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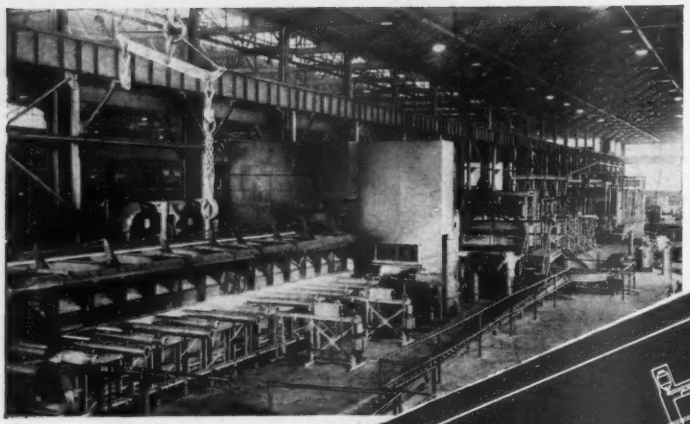
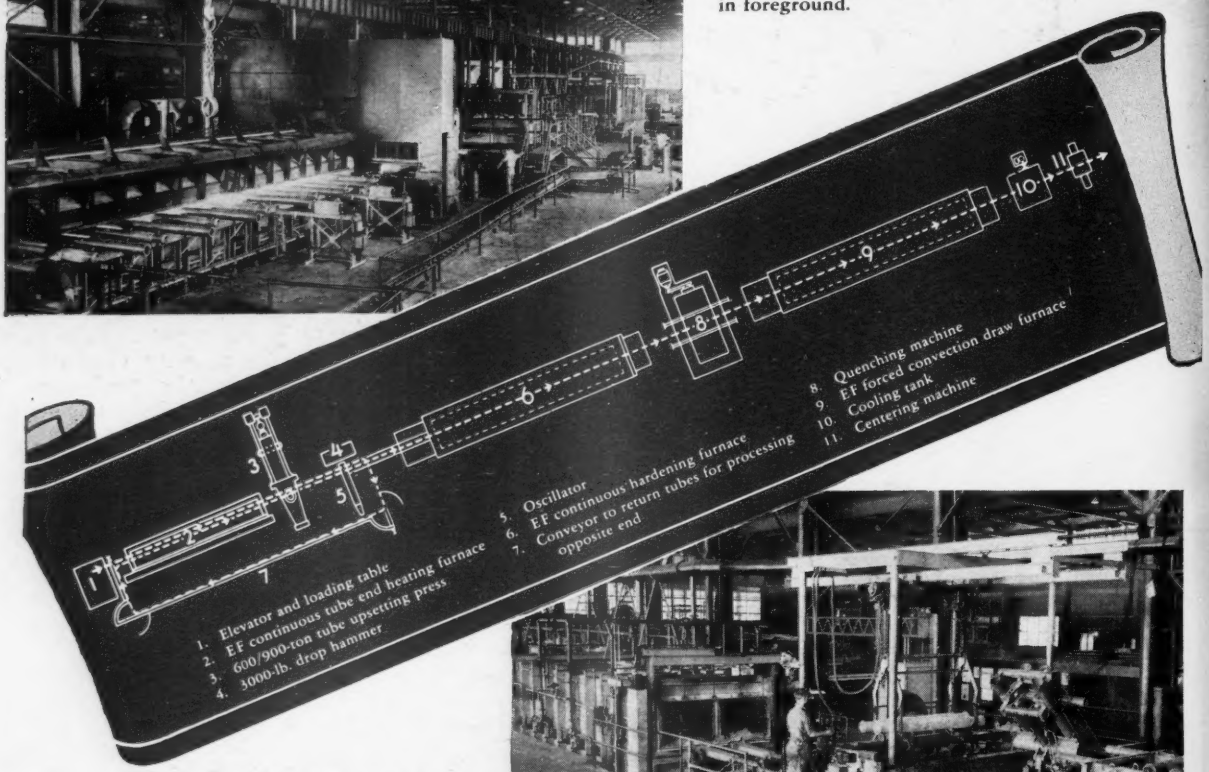
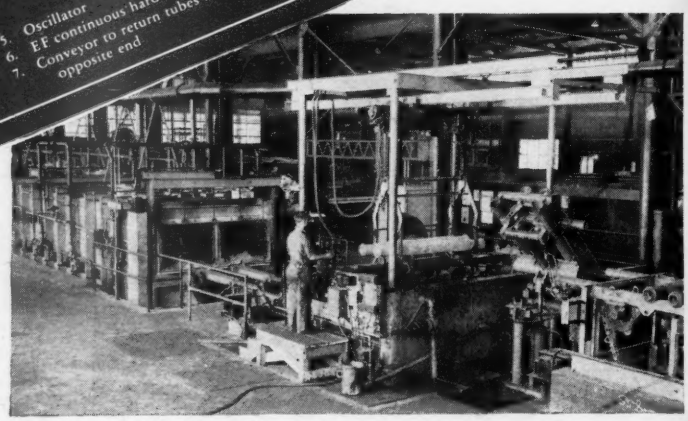


This view shows the complete automatic installation with the end heating furnace in foreground.


1. Elevator and loading table
2. EF continuous tube end heating furnace
3. 600/900-ton tube upsetting press
4. 3000-lb. drop hammer
5. Oscillator
6. EF continuous hardening furnace
7. Conveyor to return tubes for processing opposite end
8. Quenching machine
9. EF forced convection draw furnace
10. Cooling tank
11. Centering machine



Discharge end of hardening furnace and charging end of draw furnace with automatic quench between.

EF Furnaces are Important Units in

Producing the New Tubular R.R. Axles

. . . by continuous production line methods

In the Pittsburgh Steel Company's modern plant for producing the new tubular railroad axles; the upsetting press, the drop hammer, three continuous automatic furnaces, quenches, straightener and other equipment are all tied in together, in one complete continuous straight line production unit.

EF furnaces are playing an important role in this outstanding installation. An EF continuous gas fired end heating furnace and automatically controlled EF hardening and drawing furnaces are providing the accurate heating cycles specified for producing the exact physical characteristics required by the producers of these new tubular axles.

This is another example of how EF engineers are qualified to cooperate with industry in designing and building dependable production heat treating equipment for new and unusual applications and developments.

We have also made some outstanding production furnace developments for handling wire, strip and tubing which we would like to discuss with you, if interested.

Submit <u>your</u> production furnace problems to EF engineers —— it pays.

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Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

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